AUG 1 0 1943

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American Foundryman

A PUBLICATION PRESENTING ASSOCIATION AND CHAPTER ACTIVITIES

Rough Grinding Castings in the Foundry. *(Courtesy American Standards Association)*

Nickel in Tin Bronze and Red Brass, See Page 2. A.F.A. Directors Meet, See Page 5. 1944 Foundry Congress, See Page 7. Army and Air Force Specification Changes, See Page 8. Graphite Inoculation of Gray Iron, See Page 13.

August 1943

A.F.A. Directors Define Long-Range Technical-Educational Program for Foundry Industry

WHEN the A.F.A. Board of Directors met in Chicago July 21, it reviewed and appraised the work of the Association during the past year, but gave major attention to plans for the future. Particularly significant was its stressing of a long-range program of research and the publication of special books and reports of valuable material gathered through the efforts of A.F.A. technical and shop-operation committees.

Carrying out this program conceived by the leaders of the Association will require the continued generous cooperation and service of our great group of worker members.

The past history of the Association over its 47 years of "coming together and working together" is indicative of the success that this program cannot help but attain. With a present record membership of close to 6,000 and some 800 members serving on national and chapter committees, the A.F.A. is a most powerful group in promoting the friendly and cooperative advancement of our industry. It has strongly established itself in its chosen and announced field of technical educational effort, and the 1942 and 1943 Foundry War Production Congresses showed what it could do under the most difficult wartime conditions.

The Association's progress has coincided with the growth of technical control in all industrial fields. The Foundry Industry, in order to keep pace with and meet increasing competition from other products and processes, must *Work Together* for continued success.

We have been most fortunate in having a large and loyal group of unselfish workers contributing their time, experience and knowledge to Association work. Our Board of Directors now will be calling upon others, many of them the technically trained younger men entering the foundry field, to carry on its program. These younger men will find what our older workers have already found to be true . . . that committee work brings its recompense in added acquaintanceship and a broader knowledge obtainable in no other way.

The American Foundrymen's Association is not just a "central office." It is composed of thousands of men of the Foundry and Allied Industries, all working together for the common cause of advancing the Casting Industry. Every man in the national office has before him constantly the one purpose of serving *You Who Are the Association,* by carrying on to completion the sound and considered plans of the Association's Officers and Directors.

R. E. Kennedy

R. E. KENNEDY, *Secretary*
American Foundrymen's Association.

ROBERT E. KENNEDY *was elected Secretary and, under the President and Board of Directors, the administrative head of the Association, at a meeting of the Board held July 21, at the Palmer House, Chicago, following resignation of C. E. Westover as Executive Vice-President. A short biographical sketch of Mr. Kennedy, who has been connected with A.F.A. since 1921, will be found on page 6 of this issue.*

American Foundryman

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HEADQUARTERS, Room 1398, 222 West Adams St., Chicago, Ill.

CONTENTS

AUGUST, 1943
VOL. 5 — NO. 8

	Page
A.F.A. Directors Define Long-range Technical-Educational Program for Foundry Industry, *by R. E. Kennedy*	Inside Front Cover
Experiments on the Substitution of Nickel for Tin in Tin Bronzes and Red Brass, *by A. H. Hesse and J. L. Basil*	2
Association Directors Chart Course of Greater Service to Entire Industry	5
It's Buffalo in '44—Board OK's Plans for Congress and Exhibit Next April	7
How Redesigns and Specification Changes are Approved by Army and Air Force, *by T. J. Little and C. E. Duval*	8-9
The Effect of Graphite Particle Size in the Inoculation of Gray Cast Iron, *by Harry R. Dahlberg*	13
A.F.A. Soon to Publish New Malleable Melting Symposium	17
What Every Foundry Supervisor Should Know About the Slings in His Shop, *by F. L. Spangler*	19
Correct Way to Make One-Hand Crane Signals	20
New A.F.A. Booklet to Cover Magnesium Foundry Practice	21
Dr. Ries Reviews 1942 British Report on Steel Molding Sands, *by Dr. H. Ries*	22
Presenting the 1943 Winners in National A.F.A. Apprentice Contests	24
New Association Members	25
Government Orders of the Day for Industry	27
A.F.A. Chapter Activities and News	28
Organizing New A.F.A. Chapter Deep in the Heart of Texas	30
Abstracts of Current Foundry Literature	31

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The following paper (condensed from article "Nickel in Bronze," Journal of American Society of Naval Engineers, vol. 55, No. 1, Feb. 1943, pp. 44-71) gives the results of experiments on the effect of substituting nickel for various percentages of tin in tin bronzes and red brass, with particular emphasis on density or pressure tightness. A decrease in intercrystalline shrinkage porosity (a major cause of lack of pressure tightness) is reported with one alloy, Alloy G, leading to some possibility of further conservation of tin, a critical material. Incidentally, at least one ingot producer is reported now making an alloy similar to Alloy G-2, described in the paper, from available nickel-silver scrap.

Experiments on the Substitution of Nickel for Tin in Tin Bronzes and Red Brass

By A. H. Hesse* and J. L. Basil†

*Metallurgist, Naval Research Laboratory, Anacostia Station, Washington, D. C.

†Associate Metallurgist, U. S. Naval Engineering Experiment Station, Annapolis, Md.

FOREMOST among the causes of lack of pressure tightness in castings of G and M bronzes and red brass is the presence of intercrystalline shrinkage porosity in the castings. Slow or prolonged freezing is inducive to the formation of intercrystalline shrinkage porosity. Therefore, increasing the rate of solidification will reduce the amount of intercrystalline shrinkage.

Accordingly, the least amount of shrinkage in tin bronze results when the metal is poured at the lowest possible temperature which will run the casting without forming cold shuts. However, failure to obtain maximum densities in tin bronze castings indicates that such castings are seldom, if ever, entirely free from intercrystalline shrinkage porosity. The highest density expected of tin bronzes is obtainable only within a rather limited range of pouring temperatures.

Nickel Substituted for Tin

It has been found that maximum density is obtainable over an extended range of pouring temperatures when 6 per cent nickel is substituted for 6 per cent of the tin in G bronze. This substitution renders both pouring temperature and rate of solidification less critical.

Observation of the foregoing results led to an investigation of the effects on the density of substituting nickel for various percentages of tin in G and M bronzes and red brass. The effects on mechanical properties, fluidity, and corrosion resistance were also studied, as it was essential that these properties in the modified alloys should be as good as or better than those of the base alloys if the modified alloys were to be used.

Procedure

For some heats, charges consisted entirely of the highest quality virgin metals. For other heats, both virgin metals and selected scrap were used, as is the usual practice in most foundries. A master copper-nickel alloy was used for nickel additions.

Charges for density, tensile strength and elongation determinations were melted in a high-frequency induction furnace under a charcoal cover. Charges for corrosion resistance and fluidity specimens were melted either in the induction furnace or in a crucible type, oil-fired furnace operated with a slightly oxidizing atmosphere. Tin and zinc additions were made if necessary. Analyses of the alloys investigated are given herein in Table 1.

Test bars were poured in sand molds which had air dried for 24 hours before casting. Naval Research Laboratory fluidity test spirals were poured at five temperatures ranging between 1100°C. (2012°F.) and 1300°C. (2372°F.).

Density Determinations

Density was determined both by water displacement of test bars, and by x-ray diffraction, using a 1-inch cube which had been reduced 75 per cent by alternate cold compressing and annealing. Several heats of each composition were poured to obtain data for mechanical proper-

Table 1

Chemical Analysis of Alloys Involved in Investigation of Substitution of Nickel for Tin

Element		CHEMICAL COMPOSITION, PER CENT G	G*	G-1	G-1*	G-2	G-2*	M	M-1	M-2	R.B.	R.B.-1
Copper	Nominal	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	86.0	85.0	85.0
	Maximum	88.9	88.9	88.8	88.4	89.0	88.8	88.2	89.9	86.5	85.4	85.9‡
	Minimum	88.0	85.8	87.5	88.0	87.4	88.1	87.7	86.9	85.9	85.2	.....
Tin	Nominal	9.0	9.0	6.0	6.0	3.0	3.0	6.5	5.5	6.5	5.0	2.5
	Maximum	9.2	10.2	7.1	7.1	3.6	5.0	6.7	6.0	6.5	5.3	2.4‡
	Minimum	7.8	7.7	4.3	5.9	2.4	2.9	6.3	4.7	6.1	4.8	.....
Nickel	Nominal	0.0	0.0	3.0	3.0	6.0	6.0	.....	1.0	2.0	.....	2.5
	Maximum	0.8	1.5	4.0	3.0	6.1	6.0	.....	1.0	2.0	.....	2.3‡
	Minimum	0.0	0.0	2.0	2.0	5.6	4.2	.....	1.0	2.0	.....	.....
Zinc†	Nominal	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	5.0	5.0
	Maximum	3.0	3.3	4.0	2.8	3.9	2.8	4.2	4.4	4.3	4.7	4.8‡
	Minimum	1.9	1.9	2.9	2.5	2.5	2.3	3.8	3.3	3.4	4.5	.....
Lead	Nominal	0.00	0.00	0.00	0.00	0.00	0.00	1.5	1.5	1.5	5.0	5.0
	Maximum	0.09	0.04	0.06	0.02	0.32	0.02	1.5	1.5	1.8	5.2	4.7‡
	Minimum	0.00	0.00	0.00	0.00	0.00	0.00	1.3	1.1	1.1	4.9	.....
Number of Heats		7	8	7	4	6	6	5	7	4	3	1

Explanatory Marks: (R.B.) Red Brass. (*) Type 11A Test Mold; others type 10A Test Mold. (†) By difference. (‡) Chemical analysis of one heat.

ties versus pouring temperature curves.

Corrosion tests were made, using the brackish Severn River water. Strips cut from rectangular plates were tested in still water and at a velocity of 30 ft. per sec. Cylindrically shaped specimens were tested at a velocity of 15 ft. per sec.

Results Obtained

Average density, tensile strength and elongation have been plotted against pouring temperatures for the alloys observed, as shown in Figs. 1, 2 and 3. Standard deviations from the average at each pouring temperature are also indicated.

Density is a good measure of porosity. If an alloy is capable of maintaining a high "as cast" density over a wide pouring range with a small standard deviation over the entire range, few castings should be rejected because of leakage.

Effect on Densities

Substitution of nickel for tin caused only small changes in average densities. However, replacement of 6 per cent of the tin in alloy G reduced the standard deviations considerably (see alloy G-2, Fig. 1). Likewise, substitution of nickel for 1 per cent tin in alloy M narrowed the standard deviation band (see alloy M-1, Fig. 3).

Only one heat of modified red brass was poured, for the corrosion resistance fell far below that of the standard red brass. (See Fig. 2).

Tensile strength and elongation requirements were met by all alloys. Cases where the mean curves were slightly lower were compensated by having uniformly small standard deviations.

Effect on Fluidity

Replacement of 6 per cent tin by nickel markedly lowered the fluidity of alloy G. Replacement of 2.5 per cent tin by nickel lowered the fluidity of red brass. Consequently higher than normal pouring temperatures are indicated for alloys G-2 and R.B.-1. Modification of alloy M showed little change in fluidity.

Microscopic examination revealed a cored structure with intercrystalline shrinkage cavities between dendrites in all alloys except G-2.

Corrosion Tests

Corrosion tests conducted in still water showed no variation in corrosion rate of modified G and M alloys. A small increase

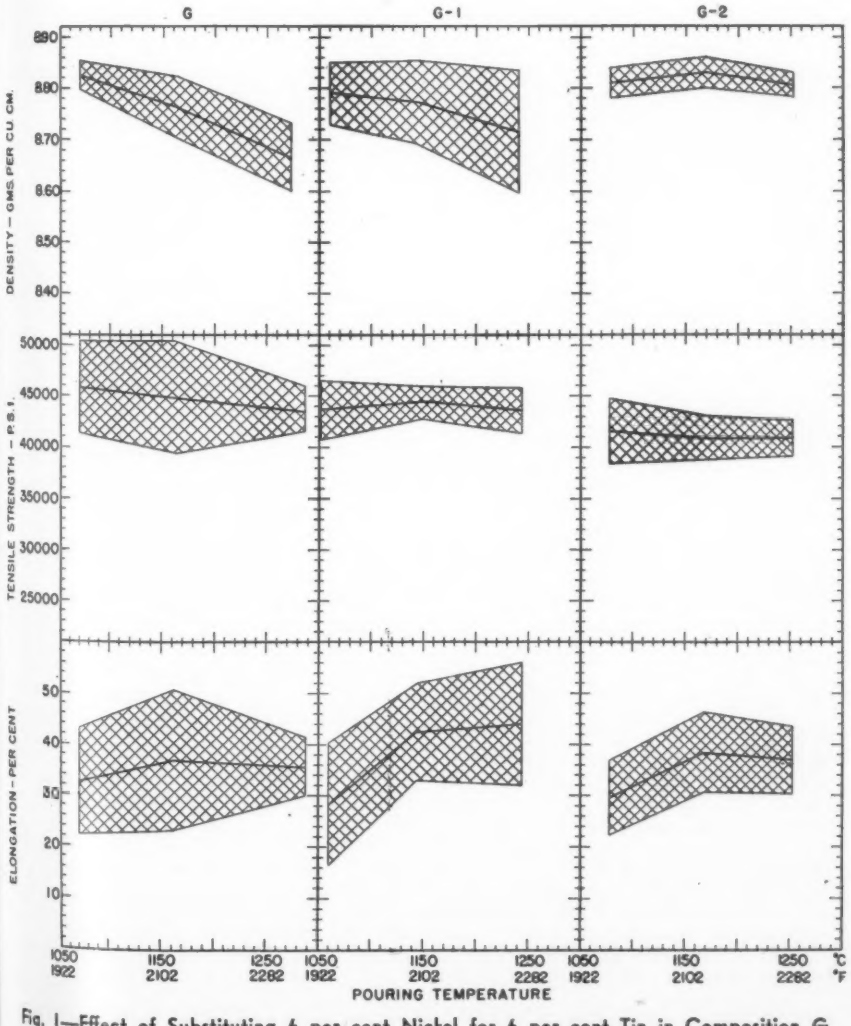


Fig. 1—Effect of Substituting 6 per cent Nickel for 6 per cent Tin in Composition G Bronze. Standard deviations in density were reduced considerably.

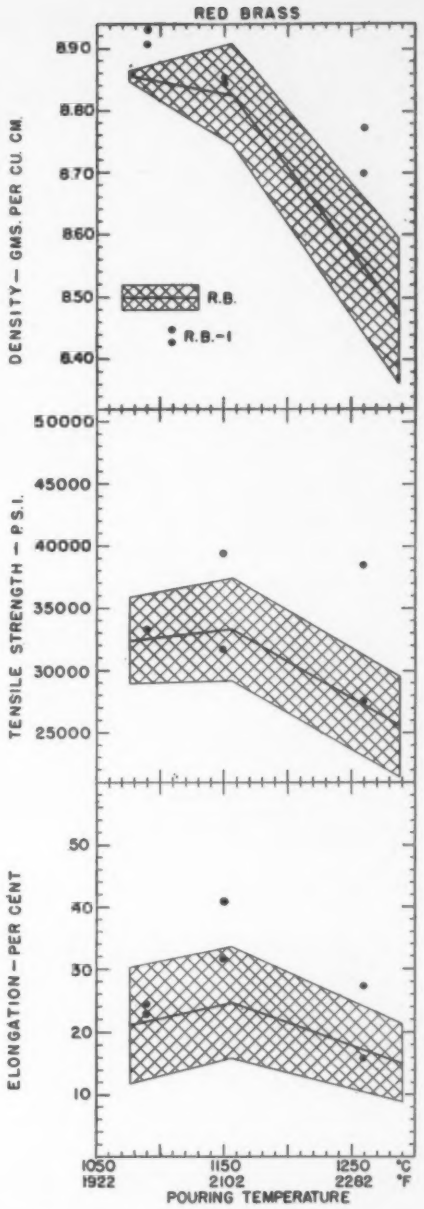


Fig. 2—Effect of Substituting Nickel for Tin in Red Brass. Only one heat of modified red brass was poured when it was found that corrosion resistance fell far below that of standard red brass.

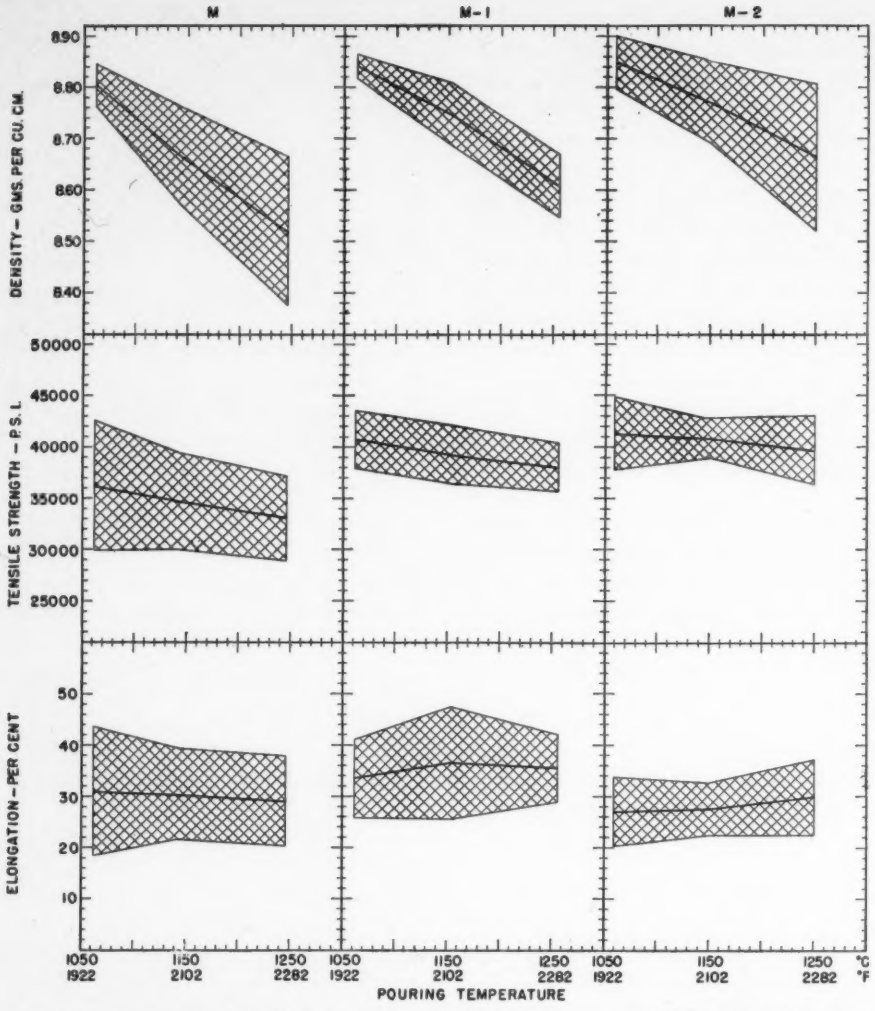


Fig. 3—Effect of Substitution of 1 per cent Nickel for 1 per cent Tin in Alloy M. The standard deviation band of density is narrowed somewhat.

in corrosion rate was observed for red brass in which 2.5 per cent tin had been replaced with nickel.

In tests conducted with a 30 ft. per sec. velocity, the corrosion rate of G alloys increased slightly as the tin replacements became larger. Beyond 4 per cent replacement, the corrosion rate increased rapidly.

The corrosion rate of M alloys increased rapidly when 3.5 per cent tin was replaced by an equivalent amount of nickel. The corrosion rate of red brass with a 2.5 per cent replacement of tin was much greater than normal.

A slight increase in the rate of corrosion was observed in specimens of the two last mentioned alloys rotated at 15 ft. per sec. velocity. Alloys with an increased corrosion rate developed a less tenacious oxide coating than the base alloys.

Conclusions

Three conclusions may be drawn from studies of the foregoing test results:

(1) Substitution of nickel for tin decreases the amount of intercrystalline shrinkage porosity in alloy G, but has little effect on the amount in alloy M and red brass.

(2) Physical properties are not affected by replacements of less than 7.5 per cent tin by nickel.

(3) The amount of tin which may feasibly be replaced by nickel depends upon the corrosion conditions under which the alloy will serve.

Committee Acts to Correlate Procedures

THE Technical Activities Committee, under the chairmanship of F. J. Walls, International Nickel Co., Detroit, met in Pittsburgh, June 29, for the purpose of formulating rules of procedure for divisions and general interest committees of the Association. A set of rules was drawn up to be submitted to the Board of Directors for final approval.

In addition, the committee reviewed the progress being made by the divisions and general interest committees of the Association. Attention also was given to the publication program of A.F.A. for the year ahead.

Urge More Segregation of Alloy Steel Scrap

OFFICIALS of the Steel Division of WPB stated recently that stocks of virgin alloying metals are being rapidly depleted, and that a considerable tonnage of alloys is being dissipated because of improper segregation and identification of scrap. Although Order M-24-c, issued about a year ago, requires segregation of alloy scrap, it is stated that many producers, dealers and steel mills have failed fully to comply.

It is claimed that much of the available alloy steel scrap, containing invaluable elements such as nickel, molybdenum and chromium, is not finding its way back to furnaces as alloy scrap. To help remedy this situation, Supplementary Order M-24-c was issued July 6 and is expected to make segregation easier. It also contains revised categories covering recently developed alloy steels and irons.

In addition to providing for proper segregation of various types of alloy scrap, the revised order specifically prohibits the use of any type of scrap listed in the melting of any but alloy steel or iron.

Letters have been sent by the Steel Division to producers and users of iron and steel, and to scrap dealers, urging fullest cooperation. It is stated that all compliance powers available to WPB will be used to enforce its order requiring alloy scrap segregation. Steel mills and foundries also have been asked to initiate and continue examination of scrap receipts.

Association Directors Chart Course of Greater Service to Entire Industry

MEETING in Chicago's Palmer House on July 21 for an adjourned annual meeting, the Board of Directors of the American Foundrymen's Association made sound plans for the trying months ahead to guide A.F.A. activities along channels of greatest value to the industry. It marked the end of the second wartime fiscal year by approving a number of projects that are expected to prove of increasing importance throughout the present conflict and long afterward.

The interest shown in A.F.A. affairs by this Board, composed of busy executives whose time is indeed precious these days, was well illustrated by the fact that 16 of the 17 Directors were present. It was shown also by action of the Board authorizing the holding of more Board and Executive Committee meetings in the future than has been the practice heretofore.

Reports were presented for the six A.F.A. Divisions—Gray Iron, Steel, Malleable Iron, Brass and Bronze, Aluminum and Magnesium, and Patternmaking—as well as for the general interest committees. Their activities during the past year were reviewed, and plans for the future considered.

Report on Membership

One interesting report submitted was that of the Membership Committee, presented by past Director B. D. Claffey, General Malleable Corp., Waukesha, Wis., who was invited to attend the meeting in order to sum up the work of his committee in increasing A.F.A. membership during the past year. Working with the membership committee chairmen of all A.F.A. Chapters, Mr. Claffey reported that during the year 1,172 new members were added, bringing the total membership to 5,665 as of June 30, 1943, the highest membership in Association history.

A report was submitted by a special committee appointed by President D. P. Forbes late in his administration to consider revision of Articles 9 and 10 on nomination and election of A.F.A. officers and directors. This committee was carried on by President L. C. Wilson with Past President H. Bornstein, Deere & Co., Moline, Ill., as Chairman, and the following members:

J. W. Bolton, The Lunkenheimer Co., Cincinnati.

E. C. Hoenicke, Eaton Erb Foun-

National Officers and Directors of A.F.A. take time off for luncheon at the Palmer House, Chicago, while charting the future course of the Association at their annual Board meeting, held July 21. Directors, guests and members of the staff, left to right around the table: Roy M. Jacobs (left front), Standard Brass Works, Milwaukee, Wis.; C. E. Hoyt, Manager of Exhibits; R. J. Allen, Worthington Pump & Machinery Corp., Harrison, N. J.; C. E. Westover, formerly Executive Vice-President; Vice-President R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.; N. F. Hindle, Assistant Secretary; W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa.; S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, Minn.; past Director B. D. Claffey, General Malleable Corp., Waukesha, Wis.; M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill.; D. P. Forbes, Gunite Foundries, Inc., Rockford, Ill.; President L. C. Wilson, Reading Steel Casting Div., American Chain & Cable Co., Reading, Pa.; Secretary R. E. Kennedy; I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind.; J. G. Coffman, Los Angeles Steel Casting Co., Los Angeles, Calif.; Miss P. Mockler, staff; Miss Jennie Reininga, Assistant Treasurer; Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, Ohio;; J. E. Crown, U. S. Naval Gun Factory, Washington, D. C.; Vaughan Reid, City Pattern Works, Detroit; H. S. Simpson, National Engineering Co., Chicago; L. N. Shannon, Stockham Pipe Fittings Co., Birmingham, Ala.; Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

A.F.A. President L. C. Wilson (left) presents a certificate of Honorary Life Membership in the Association to retiring President D. P. Forbes at the annual Board meeting, July 21, in Chicago.

dry Div., Eaton Mfg. Co., Detroit.
C. E. Hoyt, Chicago.
Roy M. Jacobs, Standard Brass Works, Milwaukee, Wis.
Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.
R. G. McElwee, Vanadium Corp. of America, Detroit.
D. J. Reese, International Nickel Co., Detroit.
H. M. St. John, Crane Co., Chicago.
F. G. Steinbach, *The Foundry*, Cleveland.
F. J. Walls, International Nickel Co., Detroit.
President L. C. Wilson, *ex officio*.

The Executive Committee, at a meeting held June 19, instructed the special committee to consider and recommend general revision of by-laws, and the report submitted resulted from a meeting of the special committee in Pittsburgh, June 30.

Due to lack of time for review, the Board accepted this comprehensive report with thanks for the fine work done and referred it to the Executive Committee for early consideration and resubmission with recommendations for letter ballot approval of the Board. Under the by-laws, the revisions then will be submitted to the Association membership for final approval by letter ballot.

Cast Iron Study

R. J. Allen, Worthington Pump & Machinery Corp., Harrison, N. J., submitted an illuminating report as Chairman of the Gray Iron Division's Committee on High Temperature Properties of Cast Iron. He traced the need for such an investigation and the work of the committee, acting in an advisory capacity to the War Metallurgy Committee of the War Production Board.

Mr. Allen gave particular praise to the excellent work of the committee's investigators, C. O. Burgess, Union Carbide & Carbon Research Laboratories, Inc., Niagara Falls, N. Y., and T. E. Barlow, Vanadium Corp. of America, Detroit. These two volunteers collected a great deal of valuable information on the use of cast iron at temperatures above 400°F., through numerous personal visits to operating foundries.

The material thus gathered indicates a definite possibility of revising upward existing specifications. Mr. Allen stated that the first report resulting from this investigation is expected to be released by the War Metallurgy Committee shortly.

Other Special Reports

An operating budget for 1943-44 was submitted by the Finance Committee and approved, indicating that the Association is in sound financial condition. Chairman of the Finance Committee is D. P. Forbes, the other members being Vice-President R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., and President L. C. Wilson.

Acting upon the recommendation of the Executive Committee, the Board approved the holding of the 1944 Convention in Buffalo, N. Y., with provision for a Foundry Show. Details of this decision, and announcement of the 3d War Production Foundry Congress to be held next April, will be found on page 7 of this issue.

The report of the Cupola Research Committee was submitted by Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., on behalf of Chairman R. G. McElwee, Vanadium Corp. of America, Detroit. This report reviewed the extensive progress being made in preparation of the cupola handbook, which it is expected will be available for publication early next year.

In conjunction with the work of the Sand Research Committee, an Executive Committee recommendation was approved by the Board, requesting an appropriation for continuing the investigation of steel foundry sand properties at elevated temperatures. This work now is being carried on at Cornell University, Ithaca, N. Y., under Association sponsorship, and is expected to produce valuable material.

In considering the report on publications, the Board approved a recommendation of the Executive Committee that a Pre-Convention issue of the A.F.A. monthly magazine *"American Foundryman"* be published in 1944 on the same basis as the April 1943 issue. A publications committee of the Board, to work with the Association staff on magazine policy, was authorized and shortly will be announced by President Wilson.

Staff Officers Elected

In selecting officers of the Headquarters staff, the Board voted to combine the offices of Executive Vice-President and Secretary as provided for in the by-laws, and R. E. Kennedy was elected Secretary. Under the direction of the President and Board of Directors, Mr. Kennedy becomes the administrative head of the Association, thus filling the vacancy created by the resignation of C. E. Westover as Executive Vice-President, as announced at the St. Louis Congress in April.

Born in Vincennes, Ind., Mr. Kennedy graduated from Winona Technical Institute, Winona, Ind., in foundry practice, and from the University of Illinois, Urbana, Ill., in industrial education. Following graduation he was an instructor in foundry practice at the university from 1910 to 1917.

During World War I he was in service with the U. S. Ordnance Department, spending some time in the steel foundry at Watertown Arsenal, and at Aberdeen Proving Grounds, testing ordnance for the Government. After the war he returned to the University of Illinois as Assistant Professor in charge of foundry work, and also served as Assistant Superintendent of Foundry Training, U. S. Training Service, under the U. S. Department of Labor.

In 1921 Mr. Kennedy became Assistant Secretary of A.F.A., was elected Technical Secretary in 1925, and was first elected Secretary of the Association in 1938. In addition to his long connection with A.F.A., he has a broad industrial background, as chemist, molder, coremaker, time study man, assistant foundry superintendent, and mechanical methods engineer.

Mr. Kennedy has played an active part, with A.F.A., in the development of foundry sand control, pattern standardization, foundry refractories, and many other projects of great value to the industry.

Other staff officers elected by the Board are as follows: C. E. Hoyt, Treasurer; N. F. Hindle, Assistant Secretary; Jennie Reininga, Assistant Treasurer; Wm. W. Maloney, Staff Assistant.

Manual for Divisions

A manual for the conduct and procedure of Divisions and Committees of the Association was submitted by Secretary Kennedy on behalf of the Technical Activities Correlation Committee, and approved by the Board. The manual is expected to clarify procedures and develop a desirable degree of uniformity in conducting technical activities work and submitting reports.

It's Buffalo in '44---Board OK's Plans for Congress and Exhibit Next April

ACTING upon a recommendation of the Executive Committee, the A.F.A. Board of Directors at its meeting July 21 selected Buffalo for the 1944 War Production Foundry Congress, to be held the week of April 25 under Association auspices. It also made provision for a Foundry Show in conjunction with the convention, as outlined in the following resolution:

"Be It Resolved by the Board of Directors of the American Foundrymen's Association that the Third World War Foundry Production Congress of the Association be staged in the city of Buffalo the last week of April, 1944.

"Be It Further Resolved that on this show year provision be made for Suppliers of Equipment and Materials to make their valuable contributions to War Production and Conservation through the use of exhibit booths for conference and consultation and a display of models, products and equipment that will enable them to demonstrate how their equipment will aid in increasing the production of War Products and Conservation of Materials.

"Be It Further Resolved that with a view to complying with the request of the Office of Defense Transportation to hold to a minimum freight and truck transportation, exhibitors be restricted to the use of Standard Booth Equipment supplied by the Association and which is available in the city of Buffalo, and no 'built booth' displays be permitted.

"Be It Further Resolved that the Headquarters and Registration for this Congress, Meetings and Exhibits be located in the new Buffalo Memorial Auditorium with the Congress and Show opening on Tuesday, April 25th, closing on Friday, April 28th, 1944, and

"Be It Further Resolved that, in the event conditions develop which make advisable a change in the above plans, authority to act thereon is given the Executive Committee, working in conjunction with the Committee on Exhibits of the Board."

The recommendation of the Executive Committee was based upon the invitation of the Convention and Tourist Bureau of Buffalo, strongly supported by unanimous action of the Board of Directors of the Western New York Chapter. That the Chapter intends to do its utmost to make the meeting a success, is shown by the following paragraph from its invitation:

"In addition to our excellent facilities for the Congress, with which you are familiar, Buffalo is known as the 'City of Good Neighbors' . . . to which we might add: 'and Friendly Foundrymen.'"

Leading up to selection of Buffalo for next year's annual meeting, in the reports of Secretary R. E. Kennedy and of Manager of Exhibits C. E. Hoyt before the Board, both commented on the exceptionally fine facilities they found Buffalo can offer for staging such a Congress and Show. The new Municipal Auditorium is one of the finest buildings in the country containing, under one roof, splendid facilities for both exhibits and meetings, and the city itself is readily accessible to many of the largest foundry sections East of the Mississippi.

The attendance and serious interest at both the Cleveland and St. Louis Foundry War Congresses give promise that the 1944 annual meeting and exhibit will bear out still further the Association's successful experience in staging conventions during two World Wars. The last meeting and exhibit of A.F.A. in Buffalo was staged in 1912, preceded by another Association convention without an exhibit in 1901.

Full details of the 1944 Foundry and Allied Industries Show will be announced in due time, and are being worked out in conjunction with a special committee on Exhibits of the Board, appointed by President L. C. Wilson.

The 33d annual May lecture of the Institute of Metals, London, was delivered May 19 by Prof. G. P. Thomson on "Electron Diffraction," covering theoretical aspects as well as possibilities for practical application of the effect.

The following two papers were presented on March 31 at an Educational Lecture Course on "Speeding the War Through Good Casting Design," sponsored by the Metropolitan Chapter of A.F.A. The utility of castings in war production work admittedly has been great, but can be increased still further by constant, intelligent redesign of parts intended to be cast. In these articles the machinery is described for proposing and getting approval on such redesigns or specification changes in Army Ordnance and Air Force contracts or subcontracts.

How Redesigns and Specification Changes Are Approved by Army and Air Force

Expediting Army Ordnance Approvals

By T. J. Little *

***Conservation Engineering Section, New York Ordnance District, New York City.**

THE Army Ordnance Department is one of the War Department's largest purchasing agencies. It is responsible for the procurement of all items of ammunition, weapons and fire control equipment used by the Army, as well as combat and cargo vehicles, also packing accessories for shipment and storage of such material.

In general, it may be stated that the Ordnance Department is divided into five main branches or sections, namely—Ammunition, Artillery, Small Arms, Miscellaneous, and Tank and Automotive.

The magnitude of the present Ordnance procurement program can be appreciated when thought is given to the task of supplying ordnance material for these branches, not only for the United States armed forces, but a substantial part of that now being used by our allies.

Importance of Substitutes

Obviously, in a program of such magnitude, critical materials, skilled labor and complicated machinery must be utilized to their point of maximum efficiency. Where practical, substitutes must be found for and full use must be made of such basic materials as silk, rubber, tin, zinc, aluminum, copper, nickel and so on throughout the list.

The constantly increasing demand for personnel in the armed forces requires of industry, where possible, conversion from male to female labor. In like manner, the present crisis makes it mandatory to put in effect the best foundry and machine shop practice available.

Industry is steadily increasing production of vitally needed raw materials. What the maximum production or the amounts needed will be, as the tempo of the present conflict develops, we have no way of knowing. Therefore, the objective of the Army Ordnance Department is to utilize this production and all available supplies to the fullest extent.

Redesign Next Step

The first job of industry, that of converting from peace to war time production with prevailing specifications and designs has been completed.

The next objective of industry and the subject of this article is the question of possible changes in specifications or redesigns of Ordnance material tending toward conservation or fullest possible utilization of critical materials.

Army Ordnance is anxious to receive suggestions from industry for design or specification changes and is now geared to place quick approval on those ideas or suggestions worthy of acceptance. No design or specification change can or will be approved until its field performance characteristics are proven beyond a doubt.

General Levin H. Campbell, Chief of Ordnance, appreciating the importance and possible benefits to be gained by interchange of ideas between Industry and Ordnance engineers, established on August 1, 1942 in each of the 13 Ordnance Districts throughout the United States a conversion-suggestion unit. The New York Ordnance District unit, under the supervision of District Chief, Brig. Gen. W. P. Boatwright, New York City.

Conversion Suggestions Wanted

All suggestions pertaining to change in specifications or redesign should be addressed to the New York Ordnance District, Conversion Engineering Unit, located at 80 Broadway, New York City.

This unit has been set up for the purpose of expediting the processing of suggestions pertaining to redesign or changes in specifications that affect New York Ordnance material. Those found to have sufficient merit are forwarded to Washington headquarters for final inspection and official acceptance or rejection.

Decisions in 30 Days

District offices as well as headquarters are now so staffed that unless redesign is extremely complicated or needs a great deal of testing, official acceptance or rejection of suggestion may be had 30 days after receipt of same at Ordnance District Office.

Suggestions received to date deal with changes in manufacturing processes, modification of component parts or a substitution from a critical material to

one of lesser importance. Copies of the Ordnance Bulletin "Battlenecks," featuring a number of approved changes as submitted to Army Ordnance by leading facilities throughout the United States, are available.

To stimulate the flow of ideas, a publicity program was begun in January 1943 through which it is hoped all New York Ordnance District facilities can be contacted. To date, over 50,000 letters have been sent out for distribution to facility personnel asking their cooperation in the contribution of ideas that will speed the war effort either by saving critical materials, critical machine tools or man-hours. This program gives every indication of showing good results in the relatively short time it has been in operation.

Approval on Army Air Force Redesigns

By E. C. Duval*

**Chief, Materiel Conservation Section, Materiel Center, Wright Field, Dayton, Ohio.*

THE procurement activities of the Army Air Force are grouped into four geographical procurement districts. All matters of procurement of articles for the A.A.F. in the east are handled through the Eastern District which covers the entire Atlantic coast to a line about as far West as Huntington, Pa.

Each district office, which is a part of the Materiel Command at Wright Field, Dayton, Ohio, is provided with a Production Engineering Section authorized to make engineering decisions involving aircraft or aeronautical equipment where such decisions do not affect interchangeability, safety, cost or delay in handling of items concerned and where prompt decision is necessary to prevent delay in production or delivery. This section maintains contact with manufacturers through A.A.F. Area Officers, Resident Representatives, and Inspectors in Charge at the various plants. It will be noted that contact with any of these people is contact with a representative of Wright Field.

The large quantity production necessary to meet the war needs has necessitated much redesign in a considerable portion of the equipment used by the A.A.F. The small quantities procured in peace times and the rapidity of new developments do not warrant the employment of progressive stamping dies, forgings and automatic single-purpose machines. Peacetime designs, of necessity, must be compromises which can be used in time of war until they can be revised for quantity production and adapted to the latest shop practices.

Procedure of Approval

In general, requests for approval of redesigns developed by contractors working on A.A.F. contracts, should be submitted through the most immediately available representative of the Materiel Center of the A.A.F. In the case of large prime contractors manufacturing air frames, engines, propellers, etc., a commissioned officer of the Materiel Command is stationed at the prime contractor's plant as a Resident Representative to handle all matters concerning the prime contractor. In such cases complete data—which may consist of blueprints, samples, test reports, or simply a letter or wire (in simple changes such as change of material)—as to the proposed redesign is forwarded to the District Production Engineering Officer through the A.A.F. Inspector who is stationed at or who calls at their plant.

Design modifications not within the scope of the District Production Engineering Section are submitted by the district office, after examination by that office, to the Materiel Center at Wright Field for approval.

As a general rule, the process of securing approval on a desired deviation for the use of a beneficial redesign is relatively simple. Obviously, consideration must be given to the retention of existing designs for the sake of interchangeability. However, approval will be granted if the desired end warrants. In special cases, of course, exhaustive tests may be necessary before approval can be given for changes in structural or other highly stressed parts.

A.A.F. specifications covering articles of equipment to be supplied its operating services are in most cases strictly performance specifications setting up the end requirements for the equipment. Manufacturers interested in each particular article design to meet these requirements and are responsible for the materials employed to meet the performance and tests outlined in the specification. In such cases, changes proposed by the manufacturer, backed by sufficient test data to prove that the article still meets the performance requirements, usually are approved in an extremely short period of time.

Change Notices Required

Where interchangeability is likely to be affected, a "change notice" is prepared at the time a proposed redesign is submitted and six (6) copies forwarded to the Commanding General, Air Service Command, Patterson Field, Fairfield, Ohio, marked for Attention of Maintenance Division, Change Notice Unit. A seventh copy of the Change Notice is forwarded with the Engineering proposal covering the change to Materiel Command, Wright Field.

This proposal and change notice is reviewed by the engineers responsible for the development and test of the particular article, and a decision is arrived at as to the desirability of the change. When a change is approved, such approval is sent back to the district office, who in turn notifies the contractor to proceed with the change. If a change order or amendment to the contract is necessary this will follow through the contract section at Wright Field, but actual execution of the change in the manufacturer's plant need

not be held up until these legal procedures are completed.

The purpose of the Change Notice to the Commanding General, A.S.C., is to provide the Air Service Command, who are responsible for maintenance of airplanes and field use, with sufficient preliminary information concerning the change which the contractor contemplates making in his products as to enable a decision to be made regarding the desirability of the change on delivered equipment.

Field Services Affected

The notice also provides information on revisions which may require a change in maintenance tools, handbooks of operation, or service instructions for the particular article concerned. Were it not for this procedure, changes might be made which would affect service in the field and of which field maintenance crews might not be cognizant.

Submission of the Change Notice to the Air Service Command concurrently with the submission of the engineering proposal through the District Production Engineering Section sets up machinery for determination of the total number of the changed parts required for maintenance and possible field replacement, as well as for incorporation in production articles.

Most of our aircraft designers learned their trade during an era of abundance insofar as materials were concerned. The cost of the best materials was relatively small compared with the overall cost of the particular article. Hence, many designs specify materials and manufacturing methods of the highest quality.

By contrast, some of our enemies have had to work out their designs from the standpoint of using the fewest "quality" materials, making inferior substitutes suffice wherever possible. We find every day that intelligent appraisal of many articles now in production has resulted in the substitution of readily available materials for scarce materials, in simplification of manufacturing techniques and in simplification of design as a result of a fresh point of view.

In a typical case that occurred recently, the manufacturer of a hydraulic landing gear strut found that the design was not adapted to quantity production. The parts were difficult to machine and assembly was tedious and required considerable skill.

The manufacturer viewed the problem from the standpoint of redesign and has worked out a "cleaned up" design which reduces the total number of parts from 229 to 149 and has vastly simplified manufacturing and assembly problems.

Many cases occur where a manufacturer has been producing articles for years with perfect satisfaction to himself and the government but suddenly finds that tools wear out with a rapidity all out of proportion to the quantity of parts produced when he attempts the large scale production demanded at present. A change in material has cured the evil in many such cases, and the resulting article has served the purpose satisfactorily.

Designs Can Be Changed

It is suggested that, wherever possible, those who are associated with firms manufacturing articles for the A.A.F. keep in mind that there is nothing sacred about the designs in use. However, it must be borne in mind that A.A.F. equipment must be serviced in all parts of the world under all conditions and in many cases by personnel who are not too familiar with it.

It is a most difficult task to have the necessary instructions at hand for repair when and where it is needed. Changes which may be of advantage from the manufacturing end but affect interchangeability of parts should be viewed with respect to its affect on the repair of the equipment in a foreign country and under adverse conditions. It is recognized that many designs can be improved with profit to all concerned, as was the case with the shock strut mentioned above, and when the results warrant the change, approval will be given as promptly as possible depending upon the tests, if any, required to prove the new design.

Those who are functioning as subcontractors should refer suggested redesigns to the A.A.F. through the contractor who holds

Close cooperation between the designing engineer, the patternmaker and the foundryman is essential to production of successful castings . . . especially of war castings. *(Photo courtesy Machine Tool Builders Assn.)*

the prime design contract. Prime contractors working on a licensee basis must also submit their suggestions to the prime design contractor, as he is responsible for the performance of the articles constructed in accordance with his drawings and specifications. In all such cases the prime design contractor is responsible for obtaining approval of the changes from the A.A.F.

The necessity for the conservation of materials has been the cause of many redesigns and undoubtedly will continue to be as the emergencies develop.

My office has been interested in conservation of critical materials, having been established as a clearing house for all matters connected with conservation about a year ago, although conservation was a pertinent question with all engineers and others connected with development work for a considarable period of time previous to that.

Better Methods Needed

It has been found that critical materials can be conserved in two generals ways—by the substitution of less critical materials, which often entails changes in design, and by changes in manufacturing processes. The first method has received special attention up to the present time but it is firmly believed that much more material can be conserved by more efficient manufacturing methods.

A great deal of effort is being expended toward this end at the present time and an increased emphasis is to be placed upon this in the future. Several cases have been brought to the attention of the office in the past few months where scrap on high-grade materials has been reduced from above 90 per cent to less than 10 per cent by changing from a forging to a stamping.

Such a change saves not only material but also machines which can be put to other uses, and presses employed that otherwise would be idle. Many such changes have been made without affecting the interchangeability of parts in any way, and every encouragement is given to the manufacturer to work out such ideas whether or not he has a contract with the government.

Inspectors and A.A.F. representatives, who are in the plants daily, are encouraged to report processes which are wasteful of material. They themselves may not have time to formulate a recommendation as to a better method, but all such cases will be put in the hands of competent personnel to investigate and to see if more economical processes cannot be worked out.

This is not a criticism of the designer or the manufacturer but it is a condition brought about, as previously mentioned, through the peacetime design being a compromise which must naturally be revised to meet present conditions. The revised facts in many cases must be produced by another manufacturer who has the proper equipment that might otherwise be idle. This is usually very satisfactory to the contractor who is producing the complete article.

Scrap Channeled Back

A third method of conserving critical materials has been employed very effectively in several cases where large quantites of hgh-grade scrap are generated in normal manufacturing operations. This is by properly segregating the material and channeling it directly back into the production line for a specific purpose. The material is returned directly to the producer, such as a steel mill, where it is melted and returned to the manufacturer as a part of his order for raw stock. In some cases this has completely eliminated the threatened shortage of material for certain products, and is encouraged wherever feasible.

Procedure Reviewed

In closing it is desired to outline again the procedure for submitting proposed redesigns:

A proposal should be submitted to the nearest or most readily available representative of the A.A.F. with all data required for rendering a decision. This may be to the inspector stationed at or who calls at the plant, a Resident or Area Representative or, if none are known, it can be submitted directly to the District Office.

The District Office will either render a decision or forward to Wright Field for a decision. In either case the District Office will notify whether or not the change is approved and authorize proceeding with the change.

Urgent and critical changes may be submitted to Wright Field direct, but this is not necessary if it is borne in mind that the District Office and all its outlying personnel represent Wright Field and should be used to get proposals before the right people in the shortest period of time for proper attention. The people closely connected with the job often furnish information as to the importance and urgency of the change which will expedite its consideration.

New A.S.A. Standard on Pipe Flanges, Fittings

AN AMERICAN War Standard for Pressure Ratings for Cast Iron Pipe Flanges and Flanged Fittings, Class 125, was approved April 15 by the American Standards Association, as a revision of the former standard B16a-1939. The new standard, B16a1-1943, permits a range in pressure rating of 125 psi (gage) up to and including 12 in. for 21,000 psi cast iron, and 100 psi (gage) for 14 in. to 24 in. for 31,000 psi cast iron.

While this pressure rating is somewhat higher than the 1939 rating for the sizes listed, it is believed to correspond more closely to existing usage of these flanges and fittings. The standard was developed by the A.S.A. War Committee on Rating of Pipe Flanges and Fittings, on request of WPB, due to the necessity of utilizing cast iron to its fullest extent under war demands for critical materials.

American Foundrymen's Association maintains representation on a number of A.S.A. committees pertaining to foundry subjects, including Project A-21, Specifications for Cast Iron Pipe and Special Castings.

Copies of Standard B16a1-1943

may be obtained from the American Standards Association, 29 West 39th St., New York City, for 20 cents each.

Committee on Gray Iron Papers Meets

THE Program and Papers Committee of the Gray Iron Division, F. J. Walls, International Nickel Co., Detroit, chairman, met July 1 in Pittsburgh to direct the program of activities for the coming year and to review certain papers which were presented at the recent St. Louis War Production Foundry Congress. Many suggestions were offered regarding the program for the year ahead, and it was suggested that an effort be made to secure authors and papers at an early date, so that papers can be reviewed thoroughly by the committee before publication as preprints.

John Shaw Sends His Best to U. S. Friends

RECENTLY A.F.A. headquarters received an interesting letter from John Shaw of England, long one of the foremost of British foundrymen and an extensive contributor to the technical press on foundry subjects. Mr. Shaw made the acquaintance of many American foundrymen through his articles and at the time he attended the 1926 A.F.A. Convention in Detroit, where he was awarded the John A. Penton Gold Medal of the Association. He also presented at the meeting the annual exchange paper on behalf of the Institute of British Foundrymen.

John Shaw

His letter gives some interesting sidelights on wartime conditions in England today:

"First let me thank you for the various A.F.A. publications you have sent across. They are a great boon to one who is tied up as I am now. However, at 79 it cannot be expected that I should expect to be as virile as at 50, however, I have had a good life and no complaints to make.

"I do regret not being able to visit your people once again. I made two attempts but the times were such that it was not possible.

"I am not going to say anything about the war except saying that it has swallowed my only grandson and I am practically alone. We get a certain amount of hit-and-run raids here which are a nuisance, especially when they get you up at night. I was standing in my dining room a week or two ago when without a moment's notice a large plane roared down the street with all their guns full out and a few bombs dropped. They killed eleven and shattered several blocks of houses . . .

"Give my kindest regards to any friend you may meet, and with every good thing to you and yours,

Yours truly,
JOHN SHAW."

Because of wartime restrictions, it is not possible to publish the exact address of John Shaw here. However, should any of his many friends desire to communicate with him direct, A.F.A. will gladly provide his home address on written request.

36 Firms Convert to Sustaining Members

ON PAGE 25 of this issue of American Foundryman, the names of 36 Company Members of A.F.A. are listed who have just converted to Sustaining Memberships as an evidence of "their desire to further the aims and purposes of the Association." This excellent support brings to nearly 150, the total of firm members who have thus converted to the Sustaining class to date.

The large new group of conversions resulted from a personal invitation dated June 22 from A.F.A. President L. C. Wilson, Reading Steel Casting Div. of American Chain & Cable Co., Reading, Pa. In that letter President Wilson said:

"It is the vital job of A.F.A. in wartime, as it will be after the last gun is fired, to work constantly for improvement in methods of production and quality of products of our foundries. For this work we have an organization of over 5,700 members, 24 active chapters, and more than 400 men serving gratuitously on various committees. There is really only one Limiting Factor, namely, funds for carrying on essential projects."

Although minimum dues for Sustaining Memberships are $50, many have elected to pay $100 or more annually. In recognition of their support, A.F.A. has provided a special Sustaining Membership plaque, reproduced elsewhere on this page, for display in firm offices and reception rooms. Made of non-critical materials, the plaque identifies those firms who have found it possible to aid the Association's essential activities in more direct proportion to the benefits they have derived.

The new Sustaining Membership emblem is approximately 10 inches square, full size, and does not involve the use of any strategic materials. It contains a replica of the A.F.A. gold medals, reproduced in gray on a solid black background, in a silver border.

The 17,000 employees of Caterpillar Tractor Co., Peoria, Ill., set a new all-time company safety record in March with a frequency rate of only 4.16 lost time accident cases per million man-hours of work.

The following article was selected as the best paper submitted in the A.F.A. Student Engineering Essay Contest sponsored by the Committee on Cooperation with Engineering Schools. Following careful consideration of all entries by the judges, 1st Prize was awarded the author during the recent St. Louis Foundry Congress. Presentation of this paper is not intended necessarily as a contribution to the technical literature of the industry, but more as spur to the work of students and apprentices.

The Effect of Graphite Particle Size in the Inoculation of Gray Cast Iron

By Harry R. Dahlberg*

*Student at the Engineering College, University of Minnesota, Minneapolis, Minn.

THE inoculation of gray iron is a subject of increasing interest to foundrymen because it offers them a fairly reliable method of controlling the physical properties of their iron. The control of these physical properties has been attributed to the size and distribution of the graphite flakes.

In most cases expensive elements and alloys are used, such as ferrosilicon, zirconium silicide, calcium silicide, nickel, molybdenum and others. These are specifically elements which, when added to iron in increasing amounts, diminish the carbide stability which results in the precipitation of carbon from solution to the form of graphite.

Some investigators have used the economical and readily available element graphite for the inoculant and have obtained good results. With this in mind, an investigation was started in the belief that the area of the inoculant in contact with the molten metal was important and would possibly offer some explanation of the mechanism of graphitization of inoculated gray iron for which no conclusive explanation has been given.

Many investigators used inoculants in such quantities as would change the chemical composition of the metal, from which we would expect a change in the physical properties of the metal. However, variations in the behavior of the metal still persist when the chemical composition is held constant, and the less apparent factor of the inoculant's particle size is discussed in this paper.

Table 1

Analysis of Cast Iron

Carbon, per cent	3.31
Silicon, per cent	1.80
Manganese, per cent	0.46
Sulphur, per cent	0.062
Phosphorus, per cent	0.173

Table 2

Composition of Heats

Heat No. 1:	160 lb. cast iron 40 lb. steel scrap 200 lb. total
Heat No. 2:	160 lb. cast iron 40 lb. steel scrap 8 lb. silvery pig (15% Si) 208 lb. total
Heat No. 3:	160 lb. cast iron 40 lb. steel scrap 16 lb. silvery pig 216 lb. total

Review of Literature

The effects of superheating have been reported by various investigators.[1,2,3,4] They have shown that properties of certain irons are improved by superheating. These irons usually have a high total carbon with such alloying elements as nickel, molybdenum and chromium. The properties of low carbon irons are not improved and are often impaired when superheated. These investigations have led to several controversial theories on the graphitization of gray iron.

Piwowarsky[2] has furnished evidence supporting and undermining his graphite nuclei theory that nuclei of graphite or carbon are responsible for the precipitation of coarse graphite flakes. His evidence shows that superheating causes these graphite particles to go into solution with the iron at very high temperatures and consequently the nuclei are removed. This leads to the precipitation of fine graphite due to undercooling. He also showed that graphite dissolves very rapidly just above the liquidus.

The seeding effect suggested by Norbury and Morgan[5] supports the theory when they showed that an addition of 0.03 per cent flake graphite changed an iron that would normally be a fine "supercooled" graphite to an iron with coarse flakes.

DiGiulio and White[6] pointed out through their work that differences between "normal" and "abnormal" structures might be explained on the basis of presence or absence of graphite nuclei.

The "ferrous silicate slime"

Fig. 1—Vertical transverse test bar mold and pouring basin used in the investigations.

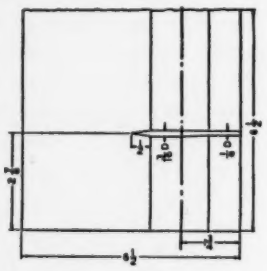
Table 3

Laboratory Data

	Test Bar No.	Graphite Size	Temp. at Inoculation, deg. Fahr.	Temp. at Pouring, deg. Fahr.	Time Diff. hrs. & min.
Heat No. 1:	11	none		2680	
	12	30 mesh	2750	2660	1-32
	13	8 mesh	2690	2660	1-0
	14	⅛ in. cubes	2710	2652	1-13
	15	¼ in. cubes	2780	2660	1-46
	16	½ in. cubes	2870	2670	2-23
Heat No. 2:	21	none		2660	
	22	30 mesh	2850	2660	2-44
	23	8 mesh	2730	2652	2-8
	24	⅛ in. cubes	2830	2652	2-56
	25	¼ in. cubes	2740	2660	2-14
	26	½ in. cubes	2840	2642	2-56
Heat No. 3:	31	none		2660	
	32	30 mesh	2780	2598	2-12
	33	8 mesh	2890	2660	3-7
	34	⅛ in. cubes	2940	2660	4-31
	35	¼ in cubes	2800	2660	2-21
	36	½ in. cubes	2770	2660	1-47

theory and the gas theory are feasible. However, the composition of the slime is too critical, and the lack of analytical methods in the gas theory make it impossible to furnish definite proof.

In the investigation on pouring temperatures of high test iron by Timmons and Crosby,[4] they found that below 2650°F., strengths are reduced considerably. Thus, throughout this investigation the pouring of test bars was done at this temperature.



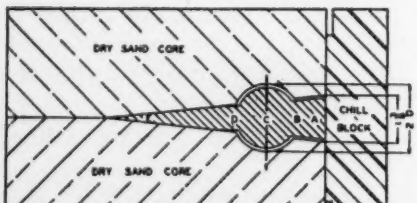
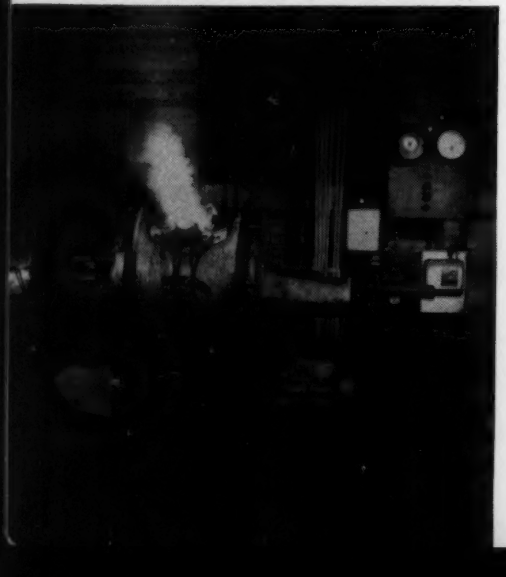


Fig. 2—Cross-sectional drawings of chill test bar employed.

Fig. 3—Electric furnace used in investigations was of the rocking, indirect-arc type.



Laboratory Procedure

The time required for the regular engineering curricula at the University of Minnesota made it impossible to conduct a comprehensive investigation on this phase of inoculation.

Three 250-lb. heats were cast using metal previously prepared from the cupola heat. The analysis of this metal is shown in Table 1. Steel scrap was used to decrease the total carbon of the heats. Silvery pig was used to obtain the desired silicon contents. The charges of the heats are shown in Table 2.

A low carbon iron was used to obtain the high strength desired in the absence of alloying elements, and also to accentuate the effect of the inoculant.

Molds for transverse test bars and chill test bars were baked, molds of core sand having the following composition by volume: 48 parts silica sand, 1 part linseed oil, and 2 parts water. When baked for four hours at 425°F., the mixture showed a permeability of 85 to 95.

The vertical transverse test bar mold, consisting of a double mold cavity, strainer cores, and pouring basin, is shown in Fig. 1. The chill test bar is shown in Fig. 2.

The melting unit used was a Detroit electric, rocking, indirect-arc furnace shown in Fig. 3. Melting control was difficult and temperature measurements with an optical pyrometer were discarded because of the inaccuracy due to smoke and fumes.

The metal was tapped into a 35-lb. hand ladle, and the inoculant was added to the stream. The temperature at the time of inoculation was obtained with a tungsten-graphite thermocouple.

Table 4

Chemical and Physical Data

Test Bar No.	Chemical Analysis, per cent — Total Carbon.	Graphitic Carbon.	Comb. Carbon.	Silicon	Transverse Strength	Deflection, BHN, in inches
11	2.64	0.11	2.53	1.52	2400 lb.	0.150
12	2.65	1.40	1.25	1.49	3150 lb.	0.230
13	2.66	1.35	1.31	1.53	3040 lb.	0.235
14	2.64	1.20	1.44	1.57	2925 lb.	0.185
15	2.66	0.71	1.95	1.56	2535 lb.	0.145
16	2.64	0.70	1.94	1.58	2610 lb.	0.160
21	2.62	1.83	0.79	2.27	2550 lb.	0.170
22	2.62	1.72	0.90	2.22	2650 lb.	0.190
23	2.64	1.69	0.95	2.19	2535 lb.	0.180
24	2.67	1.30	1.37	2.25	2800 lb.	0.180
25	2.63	1.70	0.93	2.21	2800 lb.	0.220
26	2.65	1.65	1.00	2.18	2840 lb.	0.190
31	2.64	1.91	0.73	3.04	2400 lb.	0.180
32	2.64	1.90	0.74	3.05	2800 lb.	0.210
33	2.64	1.85	0.79	3.07	2750 lb.	0.200
34	2.66	1.63	0.83	3.02	2435 lb.	0.190
35	2.62	1.87	0.75	3.11	2460 lb.	0.185
36	2.65	1.88	0.77	3.04	2450 lb.	0.160

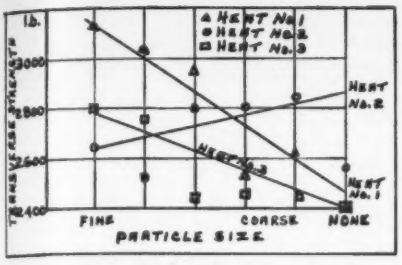


Fig. 4—Effect of particle size on transverse strength of low-silicon irons.

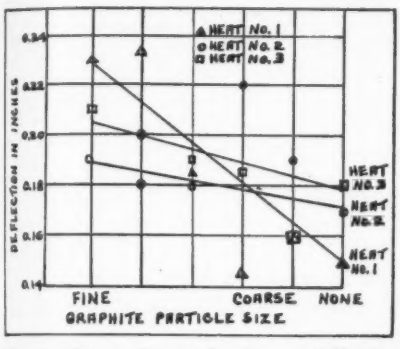


Fig. 5—Effect of particle size on deflection properties.

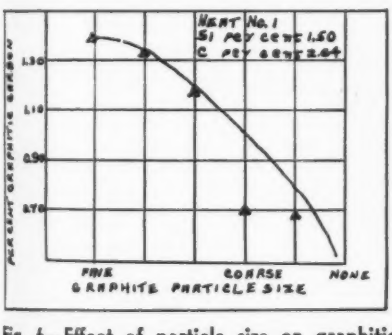


Fig. 6—Effect of particle size on graphitic carbon.

The time between the inoculation and pouring the test bars was recorded, pouring being done at 2650°F., as stated.

The temperature at inoculation was not constant because of the heat loss of the furnace, and it was not possible to hold the metal at a constant temperature throughout each heat even with the furnace in operation. This variable of inoculation temperature no doubt has affected the results of the investigation. Test bar data are shown in Table 3.

The standard procedure outlined in the A.F.A. *"Cast Metals Handbook"* was followed in making the transverse and deflection tests. The bars that were machinable were later subjected to the tensile test. These data are shown in Table 4.

The chill bars were broken and photographed, and are shown in Figs. 7, 8 and 9. The microstructure of each bar was checked and the average hardness determined on the polished specimens.

Each bar was analyzed for total carbon, graphitic carbon, and silicon. These results are also shown in Fig. 4.

The inoculant was commercial Mexican graphite, sizes used being 30 mesh, 8 mesh, ⅛-in cubes, ¼-in. cubes, and ½-in. cubes. The cubes were cut from graphite briquettes, and the 30 mesh and 8 mesh were sized by the suppliers.

Twelve grams of each size were used for inoculating 35 lb. of iron. This small quantity was used to show that it would be the particle size of the inoculant rather than a change in chemical composition that caused the changes in the physical properties and microstructures of the iron.

Summary of Data

A study of the data in Table 4 indicates that the particle size of the graphite added has a decided effect on the transverse strength in irons of low silicon content. With an increase in the silicon content in heats Nos. 2 and 3 the slope of the curve changed; this indicates that the graphite particle size was not as critical as

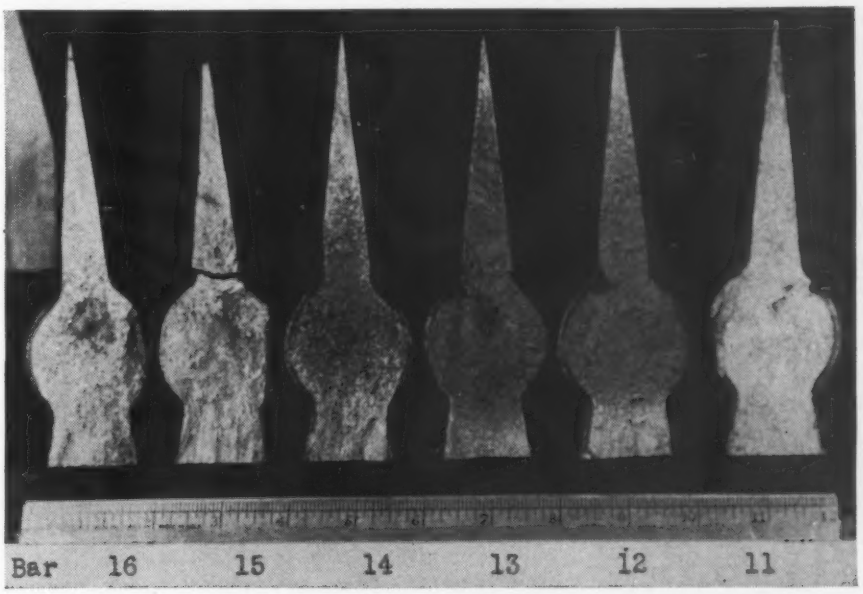


Fig. 7—Effect of particle size on depth of chill in test bars poured from Heat No. 1, greatest reduction of chill being obtained with 8-mesh graphite.

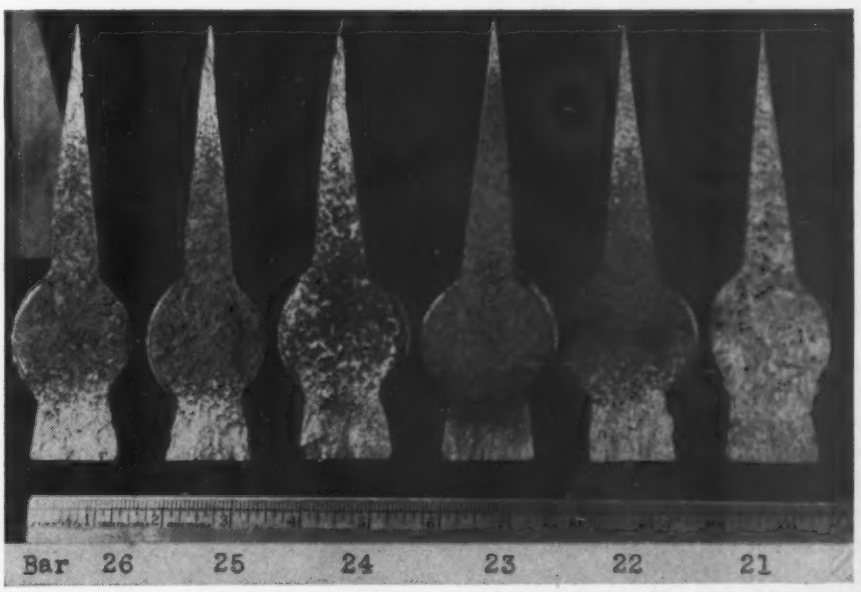


Fig. 8—Effect of particle size on depth of chill in test bars poured from Heat No. 2, greatest reduction of chill being obtained with 8-mesh graphite.

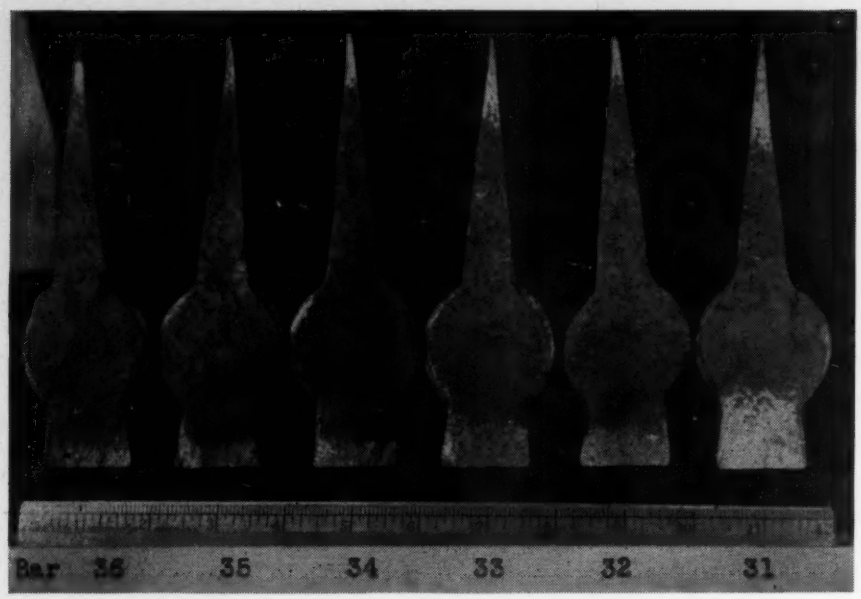


Fig. 9—Effect of particle size on depth of chill in test bars poured from Heat No. 3, coarser particles producing the greatest reduction in chill.

in heat No. 1. These curves are shown in Fig. 4.

The deflection curves acted in a similar manner, as shown in Fig. 5.

Table 4 further reveals that with low silicon irons, the particle size has a pronounced effect on the graphitization produced by the inoculant. Above 2 per cent silicon, the graphitization is probably due to the silicon content rather than to the small amount of graphite used in the inoculation. This is shown in Fig. 6.

Information on the tensile strength of the specimens could not be included in this paper, because machining is still in process. It can be reported that specimens 11, 14, 15 and 16 are not machinable, and specimens 12 and 13 machine with difficulty. Specimens from heats Nos. 2 and 3 are machinable.

Particle Size vs. Chill

The effect of the particle size on the depth of chill is shown in Figs. 7, 8, and 9. In heats Nos. 1 and 2, 8-mesh graphite seems to offer the greatest reduction in chill. This did not hold true in heat No. 3, where the coarser particles produced the greatest reduction in chill. It is evident that such a small quantity of graphite does not give a great enough reduction in the depth of chill.

The microstructures of all specimens were found to be of the dendritic and eutectiform types. Photomicrographs of specimens 11 and 12 were taken to show the drastic effect of graphite inoculation.

In melting gray iron, equilibrium conditions are seldom obtained. The inoculation of molten gray iron probably accentuates this condition of unequilibrium. The microstructure of specimen 11 shown in Fig. 10 indicates that the base iron approached equilibrium and solidified in the meta-stable iron-iron carbide system. The microconstituents are primary austenite, which transformed to pearlite surrounded by cementite. Under higher magnification the cementite contained islands of ledeburite.

Specimen 12, shown in Fig. 11, probably solidified in the stable iron-graphite system. The presence of fine graphite flakes around the primary austenite indicates that the graphite popped out of solution while cooling between the liquidus and eutectic temperatures. The fine flakes are probably due to undercooling.

When specimen 12 was resolved at 1000 magnifications, the graphite flakes were surrounded by pearlite. If the iron had solidified in the metastable system, these flakes probably would have been surrounded by ferrite . . . a result of the decomposition of cementite. Therefore, the evidence indicates that the iron solidified in the stable iron-graphite system.

Conclusions

The data presented would lead to the following conclusions:

(a) The graphite particle size in the inoculation of low-carbon, low-silicon irons has a decided effect on the transverse strength and deflection properties of the iron. When the silicon content is raised, this effect disappears.

(b) The particle size also affects the graphitization of low-carbon, low-silicon irons. As the silicon content is increased, the graphitic carbon content becomes more or less constant. In these irons, the graphitization can be attributed to the silicon content.

Fig. 10—Microstructure of Specimen 11, showing pearlite surrounded by cementite. X100.

Fig. 11—Microstructure of Specimen 12, showing fine graphite flakes around primary austenite. X100.

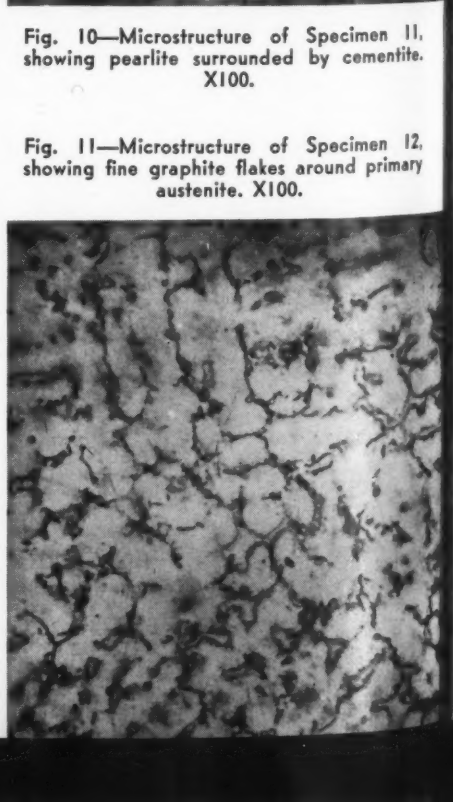


Fig. 12—Microstructure of Specimen 12, same as in Fig. 11, except at X1000, revealing graphite flakes surrounded by pearlite.

(c) Eight-mesh graphite seems to offer the greatest reduction in the depth of chill. Perhaps more inoculant is necessary.

(d) The inoculation with graphite causes the iron to solidify in the stable iron-graphite system rather than the metastable iron-iron carbide system.

Acknowledgments

The author is indebted to the Metallurgy Department of the University of Minnesota for their helpful suggestions throughout the investigation; also to Herbert F. Scobie of the Foundry Department at the University for guidance, suggestions and assistance.

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A.F.A. Soon to Publish New Malleable Melting Symposium

A NEW Symposium on Malleable Iron Melting, the second symposium on malleable iron to be published under the direction of the A.F.A. Malleable Division, now is being compiled for publication within the next month or so. This latest publication will include all papers and discussions presented in the 3-section symposium on malleable melting at the 1943 Congress plus several selected papers.

The first malleable symposium was issued in 1942, covering the Graphitization of White Cast Iron, and proved popular throughout the industry. Issuance of the 1943 collection of material will add still further to the valuable information made available through the Association. Cost of the new symposium will be nominal, covering the cost of printing and binding.

Included in the new booklet will be the following papers:

"Introduction to Malleable Melting Symposium," by Dr. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

"Air Furnace-Pulverized Coal Fired," by J. A. Durr, Albion Malleable Iron Co., Albion, Mich.

"Melting with Fuel Oil in the Air Furnace," by A. Van Lantschoot, Iowa Malleable Iron Co., Fairfield, Iowa.

"Air Furnace-Cupola Duplexing," by F. J. Wurscher, Acme Steel & Malleable Co., Buffalo, N. Y.

"Cupola-Electric Duplexing," by Chas. Morrison, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.

"Cupola Melting for Malleable Fittings," by H. W. Maack, Crane Co., Chicago.

"Open Hearth Melting," by Leo J. Kelly, Fort Pitt Malleable Iron Co., Pittsburgh, Pa.

"Brackelsberg Furnace Melting," by W. Zeunik and Kenneth Mason, National Malleable & Steel Castings Co., Indianapolis, Ind.

"Refractories Practices for Malleable Furnaces," by C. A. Brashares, Harbison-Walker Refractories Co., Pittsburgh, Pa.

"Practical Points in Malleable Melting," by J. H. Lansing, Malleable Founders' Society, Cleveland.

"Air-Furnace Cast Iron," by D. P. Forbes, Gunite Foundries Inc., Rockford, Ill.

"Developments in Melting Malleable Cast Iron," by W. R. Bean, Whiting Corp., Harvey, Ill.

"Thermal Balances and Fuel Costs of Malleable Melting Furnaces," by J. H. Hruska, Electro Motive Corp., La Grange, Ill.

"Measuring and Controlling Pouring Temperatures and Fluidity," by C. F. Joseph, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.

"Notes on the Production of Cupola Malleable Castings," by F. B. Riggan, Key Co., East St. Louis, Ill.

All 1943 Congress papers and discussions will of course be published in the Quarterly "Transactions," as well as in the annual Bound Volume early next year.

WPB Issues Revised CMP Allotment Form

A NEW application for allotment of controlled materials, CMP-4B, has been issued by WPB, with which manufacturers may obtain needed controlled materials for the third quarter of 1943. In addition, firms which were cut in their original allotments but which need materials to complete orders scheduled for this quarter, may apply on the new form for the required materials.

This situation is covered by the following quoted paragraph: "Consumers requesting additional material to be delivered during the quarter in which the request is filed (i.e., interim requests) need only show quantities in Column (h) for Third Quarter 1943 or Column (e) for

Fourth Quarter 1943." An accompanying letter giving complete details of such additional requirements should be forwarded with the application and marked "Supplemental."

Manufacturers who receive repair orders for their equipment should submit two sets of the 4-B applications, one covering controlled materials needed for new equipment, the other for controlled materials needed to fill the repair orders. The sets should be so marked. It is believed the filing of two sets will assume more importance in the future because it is reasonable to expect repair orders will increase.

Form CMP-4B also is to be used by manufacturers of Class B products in making application for allotments of materials required during the fourth quarter of 1943 and the first three quarters of 1944. Additional copies of the form may be obtained from local WPB offices.

Will YOU Help Prepare the New Cupola Handbook?

R. G. McELWEE, Vanadium Corp. of America, as Chairman of A.F.A. Cupola Research Committee, issues the following appeal to all members of the foundry industry, urging them to take a more active participation in compiling the forthcoming cupola research handbook:

"Contributions to the handbook, under the sponsorship of the Cupola Research Committee, have been numerous and well written. However, as is often the case, the actual writing of the article is left to one man, frequently the Chairman of the subcommittee. This necessarily causes the manuscript to represent his thinking as well as the thinking of the entire committee, but all with special emphasis on his thinking.

"It is the sincere desire of the Steering Committee and the A.F.A. that every available bit of talent be used in the preparation of this book.

"At the present time we are mailing preliminary mimeographed articles to members of the General Committee, for criticism. It may be that you, as an A.F.A. member, have not been placed upon this committee. If you have not been so placed and feel that you would like to express an opinion, or that you have some material that should be a part of the records assembled in this book, I wish that you would address a letter to me asking that you be placed on one of these committees.

"However, if you desire to take a less active part, please contact the chairman of the subcommittee of your interest and ask him to permit you to peruse the temporary manuscripts that interest you.

"The Cupola Research Committee will welcome suggestions from any and all members, particularly before publication of the book. We will not be so happy about receiving them afterward, because that will be too late to incorporate your ideas. Won't you please ACT NOW?"

Anyone desiring to contribute to preparation of the handbook in any way should communicate promptly and direct with R. G. McElwee, Manager, Foundry Alloy Div., Vanadium Corp. of America, 2440 Book Tower, Detroit, Mich. Chairmen of the various subcommittees are shown below.

Subcommittee on Equipment—Chairman, Jas. Thomson, Chief Plant Engineer, Continental Roll & Steel Foundry Co., East Chicago, Ind.

Subcommittee on Ferrous Materials and Alloys—Chairman, R. G. McElwee.

Sub-subcommittee on Pig Iron—Chairman, T. G. Johnston, Metallurgical Engineer, Pig Iron Div., Republic Steel Corp., Republic Bldg., Cleveland.

Sub-subcommittee on Scrap—Chairman, Max Kuniansky, General Manager, Lynchburg Foundry Co., Lynchburg, Va.

Sub-subcommittee on Alloys—Chairman, R. G. McElwee.

Subcommittee on Slags, Fluxes, Desulphurizers—Chairman, G. S. Evans, Metallurgist, Mathieson Alkali Works, 60 E. 42d St., New York.

Subcommittee on Fuels and Combustion—Chairman, S. C. Massari, Captain, U. S. Army Ordnance, Chicago (Mail address: 1443 Franklin Ave., River Forest, Ill.).

Subcommittee on Operation and Process—Chairman, H. K. Briggs, Sales Metallurgist, Miller & Co., 332 S. Michigan Ave., Chicago.

Subcommittee on Refractories—Chairman, Prof. J. F. Oesterle, Metallurgical Engineering Dept., University of Wisconsin, Madison, Wisconsin.

New Booklet Tells of "Spread Work" Effort

THE Smaller War Plants Corporation, established to assist small businesses in obtaining subcontracts on war production work, has issued a booklet "Spreading the Work," describing the corporation, its functions, powers and organization. In the introduction Brig. Gen. Robert W. Johnson, Chairman, stresses the importance of assistance to the small businessman. The method is described by which small plants with available capacity become eligible to bid on available procurements.

New WPB Malleable Iron Advisory Group

THE War Production Board announced July 12 the formation of a Malleable Iron Industry Advisory Committee, naming George F. Hocker the Government presiding officer. Other committee members:

C. S. Anderson, Belle City Malleable Iron Co., Racine, Wis.; L. A. Dibble, Eastern Malleable Iron Co., Naugatuck, Conn.; Chas. A. Gutenkunst Jr., Milwaukee Malleable & Grey Iron Works, Milwaukee, Wis.; A. F. Jackson, Michigan Malleable Iron Co., Detroit; W. H. Moriarity, National Malleable & Steel Castings Co., Cleveland; K. M. Smith, Lancaster Malleable & Steel Corp., Lancaster, N. Y., and John Wagner, Wagner Malleable Iron Co., Decatur, Illinois.

Today's high-pressure operating conditions make it more necessary than ever that greater attention be given such common, every-day articles as the slings for handling materials by overhead cranes. This article stresses the supervisor's responsibility for avoiding accidents, preventing product damage and reducing production delays through the better understanding of how slings should be used and cared for. It is his job to see that the right sling is used for any load, that the proper hitch is made, and that slings are carefully handled and regularly inspected. The article is reprinted from September, 1942, issue of "Supervision."

What Every Foundry Supervisor Should Know About the Slings in His Shop

By F. L. Spangler*

**Mechanical Engineer, Chicago.*

EVERY rigger and crane operator, as well as the floor foreman in areas served by cranes, should be well grounded in safe practices concerning slings and hitches. The rigger alone is responsible for making the hitch. But it is the crane operator's responsibility to know whether the load will lift, and he should refuse to pick up the load if there is any doubt in his mind that the hitch is unsafe.

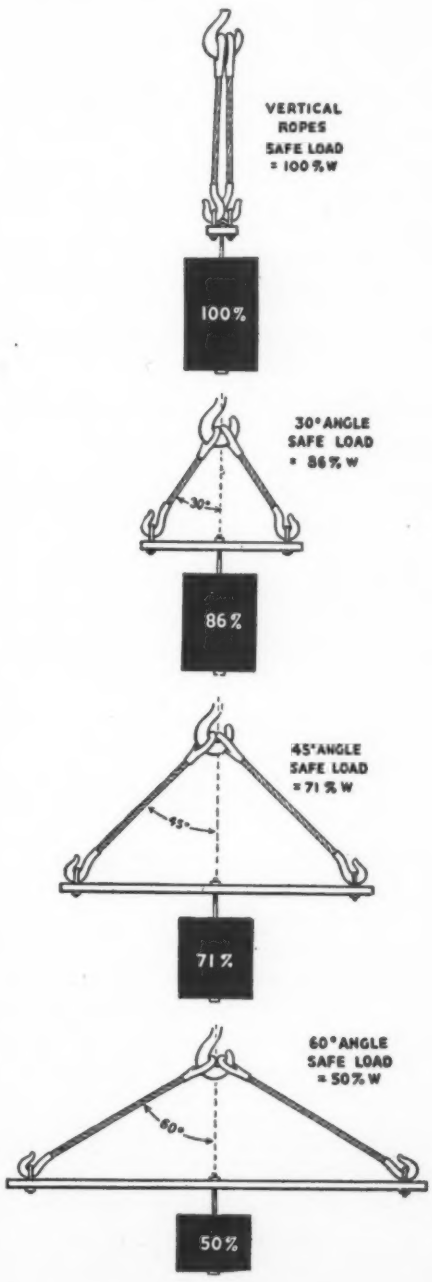
In all matters affecting the safe picking up and transferring of the load, the crane operator is supreme, and he has authority (either implied or expressed) to order the making of any type of hitch he believes to be required in the interests of safety. However, the crane operator does not often find it necessary to exercise this prerogative, especially where the riggers themselves are well qualified for their work.

How Not to Test Sling

Watching the load as the crane picks it up will reveal whether the sling is strong enough and whether the rigger made a good hitch. But that is apt to be an expensive and painful way to learn how to make a hitch—or rather, how *not* to make a hitch.

It's like setting a house on fire to see if it will burn, in the hope it will not. If something goes awry, the damage is done. Though the lesson is learned, think of the penalty paid!

Slings may be made of wire rope (generally preformed), iron chain, or manila rope. Which material is to be used depends on the strength desired and on the nature of the load to be lifted. For light loads, manila rope serves the purpose, and it has the advantage that it will not scar or mar the load, though a pad of soft material should be inserted between the rope and any polished surface. On the other hand, manila rope is easily cut or damaged by sharp edges. Even the edge of a packing box may inflict punishment on a manila rope. If not stored in a dry, well-ventilated place, manila rope will quickly deteriorate.



The angle at which the sling is used greatly affects its lifting capacity. At an angle of 60 degrees from the vertical (bottom), a sling will have only 50 per cent of the lifting capacity in a vertical position (top).

Where intense heat is encountered, or the sling may be exposed to the splashing of molten metal, chain should be used. Many chain slings are in daily use in foundries and steel mills. Also, the chain sling is not easily damaged by the rough edges of castings.

Wire Rope Useful

Wire rope makes good sling material because it provides high strength, is light in weight, and failure is not sudden, as with chain, but is progressive. A wire rope does not part instantly, but it generally gives warning of failure far enough in advance so a man can get out from under the load before complete failure.

In the days before wire rope was preformed, it was unruly, hard to handle and manage, and had a tendency to throw itself into loops and to kink. With internal stresses eliminated through preforming, the rope behaves more like a manila rope and, since riggers can handle it more easily, its popularity for

sling material has greatly increased.

Supervisors should understand the need for careful handling of slings. Slings should not be allowed to strike against sharp objects, as this may result in broken wires or nicked chain links, and care should be taken that they are not damaged by being dragged over sharp edges. Where the sling bears against a sharp edge of the load, it should be protected by a soft pad or a piece of wood in order to avoid damage to the individual wires and to prevent permanent deformation. Where a choker or cradle hitch is used, special care must be taken that the sling is not damaged when the load is lowered onto the floor. At the place of sling attachment, the clearance between the load and the floor should be such as to allow the sling to be removed without damage.

Since the sling forms the connecting link between the crane hook and the load, inspection should be as rigorous as with crane ropes.

Look for Stretch

All sling hooks should be regularly examined for evidence of stretch, since this is an indication of progressive failure. Hooks that show stretch should be immediately replaced.

Chain slings should be regularly inspected for bent or nicked links. In one manufacturing plant employing many chain slings, any link that has a nick deeper than ⅛ inch is removed. This plant anneals its chains every three or four months, or whenever the surfaces at load-bearing points take on a polish that the trained eye of the inspector recognizes as work-hardening.

The rules for wire-rope inspection should be followed for inspecting wire-rope slings. Not only should the rope be examined for broken wires and strands and for permanent deformations such as kinks and dog-legs, but particular attention should be given to the rope where it enters a hook socket or other end fitting, since it is here that fatigue breaks in the wires are most apt to develop and damage occur from improper socketing.

Another place for careful checking is that part of the sling that bears directly on top of the hook, since the rope at this point becomes permanently distorted more and more as it is used, and its original circular form changes into an ellipse. Continual spreading of the rope section in this manner results in a weakening of the rope structure at this point. Rope slings so damaged should be discarded.

Correct Way To Make One-Hand Crane Signals

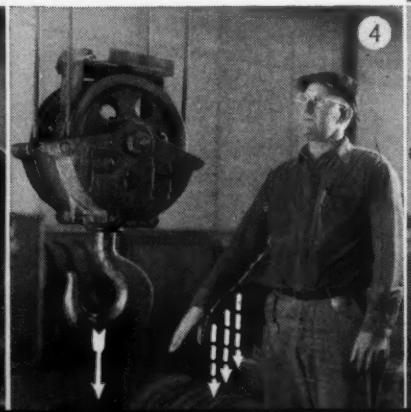
THE posed photographs shown below, reproduced through courtesy of "News and Views," employees magazine of Caterpillar Tractor Co., Peoria, Ill., were prepared in cooperation with that company's Safety Division to illustrate the correct standard method of making one-hand crane signals in a noisy shop. Knowing and using the accepted signals helps a crane operator to know exactly what the signaler wants . . . a sure way to prevent accidents.

1. HOIST: Forearm vertical. Make small horizontal circles with the hand.

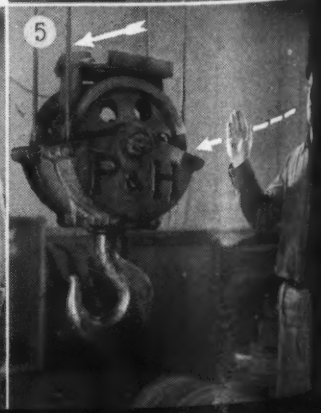
2. RACK: Arm extended, fingers closed, thumb extended horizontally, jerk hand in direction of racking.

3. STOP: Arm extended, hand level with the hip. Hold position rigidly.

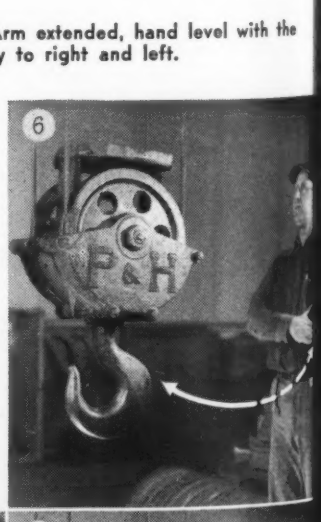
4. LOWER: Arm extended, hand below the hip. Wave forearm downward.



5. TRAVEL: Forearm vertical, hand open. Wave forearm in direction of travel.



6. EMERGENCY STOP: Arm extended, hand level with the hip. Move hand quickly to right and left.



Where sling loops are provided with thimbles, the distortion is not so severe and longer life can generally be expected.

Supervisors should be acquainted with the three types of hitches in common use. In the cradle hitch, the sling passes from the crane hook under the load and back to the hook.

Types of Hitches

The choker hitch employs a single sling, at the bottom of which is a loop which is slipped over the end of the load and draws tight when the load is picked up. The third type of hitch is the direct connection, in which the end of the sling supports the load directly, through the use of a hook, shackle, or other fitting.

There are many types of slings especially developed for specific loads, but all of their hitches are merely variations of the three types listed above. For example, a form of cradle hitch used for lifting locomotives and flat sheets consists of a rigid beam which passes under the load and is supported at each end by a wire rope. Slings can be provided with clamps that grip the edge of a plate, one type being designed for supporting the plate in a horizontal position and another type for supporting it vertically.

Sometimes the rigger may find it necessary to improvise a special sling for a load. When such a situation arises, his knowledge of the behavior of sling materials and information on where and how to use various types of hitches will be valuable.

For the safe carrying loads of slings, the manufacturer's ratings should be followed. It is customary to base these ratings on a factor of safety of 5.

Angle Fixes Capacity

When applying slings having two or more parts of rope or chain, it should be remembered that the capacity of the sling depends on its angle of repose. The highest capacity is obtained with the parts of the sling vertical. But in service, slings of this type are generally employed to grip the load at two points some distance apart, and therefore the two parts of the sling are spread out to form two legs of a triangle. The more the two parts of the sling deviate from the true vertical, the greater is the tension in the ropes or chains. For example, when the rope or chain is at an angle of 45 degrees, the safe lifting capacity is reduced by 29 per cent. Manufacturers' recommendations should be followed in determining the safe lifting capacities of slings at various angles.

Only well-trained crane operators should be employed—men who know how to handle loads with the least amount of damage to the ropes and slings. A good operator will pick up the load smoothly and easily, without jerking, thereby saving slings and ropes. When transporting loads with the cradle hitch, particular care should be taken to prevent the load from swaying to such an extent as to cause it to shift on the sling. A well-trained operator will control the bridge and trolley movements to hold swaying to the minimum and prevent spinning of the load, which also can be disastrous to slings as well as ropes.

New A.F.A. Booklet to Cover Magnesium Foundry Practice

YOUR Association now is compiling and soon will make available to the industry within the next month or two, under one cover, all of the papers and discussions on magnesium founding presented at the recent St. Louis War Production Foundry Congress, plus certain selected papers with additional material of value. The great increase in the use of this light metal for war purposes has resulted in many requests for up-to-date information on magnesium foundry practice, and the new publication should meet a real need.

The 1943 convention material on magnesium will be offered as a separate publication, at a nominal fee to cover the cost of printing and binding. Most of the material also will appear in the Quarterly "Transactions" of A.F.A., and in the annual Bound Volume at the end of the year.

Papers included in the new publication on magnesium are as follows:

"Temperatures Developed in Sand Cores During Casting of Magnesium Alloys," by A. T. Peters and M. V. Chamberlin, Dow Chemical Co., Midland, Mich.

"Chemical Analyses of Sands for Magnesium Castings," by W. E. Cramer, Washington State College, Mining Experiment Station, Pullman, Washington.

"Magnesium Foundry Sand Control," by F. S. Brewster, Dow Chemical Co., Midland, Mich.

"Molding and Core Sand Characteristics in a Light Metal Foundry," by A. V. Lorch, Eclipse Aviation Div., Bendix Aviation Corp., Bendix, N. J.

"Sand Practice in a Canadian Light Alloy Foundry," by A. E. Cartwright, Robert Mitchell Co. Ltd., Montreal, Quebec.

"Magnesium Foundry Sand Practices," by M. E. Gantz, American Magnesium Corp., Cleveland.

"Fluoroscopic Examination of Light Alloy Castings," by A. E. Cartwright, Robert Mitchell Co. Ltd., Montreal, Quebec.

"Fire Prevention and Control in Magnesium Foundries," by R. I. Thrune, Dow Chemical Co., Midland, Michigan.

"Mechanical Exhaustion of Fumes and Smoke; the Engineering Aspects of Collection of Dust and Fumes in Non-Ferrous Foundries and Industrial Operations," by John Kane, American Air Filter Co., Louisville, Kentucky.

"Health Aspects of Safety and Hygiene Problems in Magnesium and Other Foundries," by Warren Cook, Zurich General Accident & Liability Insurance Co., Ltd., Chicago.

"Core Sand Reclamation at Elevated Temperatures," by D. Longeuville and O. Jay Myers, Wright Aeronautical Corp., Cincinnati.

"Thermal Process of Core Sand Reclamation," by W. L. Hartley, Link-Belt Co., Chicago.

"Magnesium Foundry Practice," by M. E. Brooks and A. W. Winston, Dow Chemical Co., Midland, Mich.

To facilitate the reduction of work injuries involved in the handling of materials, especially in view of today's influx of untrained workers, the U. S. Department of Labor has issued a

bulletin intended as a "Guide to the Prevention of Weight-Lifting Injuries." The bulletin, Special Bulletin No. 11, describes and illustrates basic principles of weight lifting and stresses the fundamental part that management must play by good planning, control, selection of workers, training, and constant supervision. Copies can be obtained from the Division of Labor Standards, U. S. Department of Labor, Washington, D. C.

Dr. Ries Reviews 1942 British Report on Steel Molding Sands

By Dr. H. Ries,* Ithaca, N. Y.

*Technical Director, A.F.A. Foundry Sand Research Committee.

Second Report of the Molding Materials Sub-Committee of the British Steel Castings Research Committee, 62 pages, September, 1942.

This interesting report details the results of a series of experiments which in some respects covers similar ground to that being gone over by A.F.A. Sub-Committee 6b7 on the Physical Properties of Steel Foundry Sands at Elevated Temperatures.

It is stated that an important part of the work has been to find possible alternatives to bentonite for bonding and revivifying molding and core sands. Bentonite does not occur in Great Britain, and a search for a substitute appears to be a conservation measure. The superior bonding powers of clays containing montmorillonite, the Committee says, have been confirmed.

It is claimed that certain treated varieties of Fuller's earth having bonding characteristics close to those of normal bentonites have been developed. These are said to have eliminated or greatly reduced the use of bentonite.

Sieve Analyses

The Committee also calls attention to the fact that certain sandstones, containing from 7-12 per cent of partially weathered feldspathic matter, make a useful base for steel molding sands. This is a point that might be of interest to Pacific coast foundrymen where feldspathic sandstones are abundant.

It is interesting to note that the committee had no success with the use of wetting agents.

The report first describes the tests made on a number of samples of British sands. Most of these are described as molding sands, hence, presumably have natural bond. The sieve analysis, which includes different sieves than are employed in this country, expresses the finest material as that passing a 150 sieve. It is not clear whether this includes clay. In some cases the amount of clay separated by elutriation is given, but that still leaves one in doubt.

Results of Special Tests

Another feature, quite divergent from American practice, is that what is called dry compression or dry strength is made after heating the specimens to temperatures ranging from 200°C. to 400°C. (see pp. 6, 34, 37, 41). In one place it is referred to as baking. It would seem that there is no uniformity of treatment as there is in the United States, where specimens for dry strength are heated to 110°C. (230°F.).

The results of special tests are next considered. One mixture was run to show the effect of time of mulling and number of rams on the green compression. Here it is pointed out that green compression strength increased with the time of mulling up to 4 min., but that the increase is not great beyond 2 min. Furthermore, the green compression strength increases with the number of rams up to 40, but the rate of increase is greater under 1 min. of mulling, or up to 9 blows of rammer, than it is above these limits.

It is not clear whether the time of mulling is determined from the instant the muller is started, or after the water has been mixed with the sand. When the effect of periods as short as one-half minute are given, this should have been stated.

Another fact mentioned is that "naturally bonded sands do not yield their full strength on mulling unless the rolls are sufficiently heavy and the time of mulling sufficiently long."

The authors show that the dry strength of specimens tested increases more rapidly in the first 2 min. of mulling. The specimens for these particular tests were heated for 2 hours at 200°C. and then cooled to room temperature. It is not stated, however, whether they were cooled in a desiccator.

Permeability Apparatus

Considerable attention is given to the permeability of molding sands. It is claimed that speed of drying increases with permeability.

The Committee also states that "the strength of both green-sand and dry-sand molds, and the extent to which a core sand can accommodate the contraction of a casting during cooling, are all closely related to permeability."

The Committee designed a permeability apparatus which it claims possesses advantages over the B.C.I.R.A. one because it maintains a constant air pressure during the test, and it gives some tests to show how the two differ in results obtained. The Committee does not state how its apparatus compares with the A.F.A. permeability apparatus, although in general plan of operation the two are similar. They also do not compare it with the English Richardson permeability apparatus.

The authors point out what is self-evident, that when comparing the permeability of two sand mixes they must be rammed to the same degree. They also claim that when tests are repeated on fresh test pieces, those rammed with 9 blows agree more closely than those with 3. Furthermore, they claim that the higher density of 9 rams is more nearly comparable with

foundry practice, and that for comparisons the test piece should be rammed 10 times.

They point out that the permeability curves for different clay bonds may go in opposite directions with increasing moisture content, which was already known.**

Expansion of Sands

One interesting feature, the expansion of sands, is all too briefly treated, although the Committee admits it is very important and states that it is considering further work along this line.

No description is given of the apparatus used in these tests, but the specimens were heated slowly from room temperature upward. Thus, from 200°C. (392°F.) to 700°C. (1292°F.), the heating time was 2°C. per minute or 4 hours, 10 min. The maximum expansion of three mixtures, each containing 7½ per cent of different bonding clays, ranged from 1.46 to 1.55 per cent. The Committee believes that differences of this order will not have any significant effect on the behavior of foundry mixtures containing these clays. It seems to the reviewer that shock expansion tests would duplicate casting conditions better.

Bonding Clay Tests

The Committee next discusses the use of "insulating sands" for lining feeder heads, and carried out a series of tests on different mixtures to determine the loss of heat from the "hot face" to the "cold face" of the mold. It was found that mixtures of silica sand, sawdust and clay gave the best results.

Section III of the report, covering 17 pages, is devoted to a discussion of bonding clays. After reciting the advantages of bentonite, which does not occur in Great Britain, they turned to Fuller's earth, of which there is an abundance and which they state is a calcium montmorillonite with calcium carbonate as a diluent.

One bond is a Fuller's earth, dried and ground under controlled conditions. There are several other trade-name bonds similarly prepared. The first mentioned bond has a bonding efficiency 70-80 per cent of that of the average Wyoming bentonite. To get full bonding power, heavier and longer mulling may be required. To obtain good results with skin-dried molds, some organic material (about 1 per cent) is added.

For the manufacture of dry-sand steel castings from naturally bonded sands, the addition of up to 20 per cent of the total clay content of this type bond gives better results.

Another bond is a Fuller's earth which has been treated chemically (how, is not stated) to increase the green strength.

The properties of these trade-name bonds, shown in Table 1, are of interest.

It is stressed here again that weight of mullers and time of mulling are important in the use of these substitutes for bentonits. Several other domestic bond clays are being used.

The Committee states that search has proved that clays which may be of value for foundry purposes have been found in quantity in the British Isles.

The fourth section of the report discusses core compounds and core sand mixtures. This deals with classifications, properties and uses, and means of reducing their consumption.

The Committee's report is most interesting and should be read in full to be appreciated.

TABLE I

Properties of Bentonite and Two Trade-Name Bonds

	Moisture, Per Cent	Permeability	Green Compression Strength	Dry Strength at 200°C. (390°F.)
Bentonite—3 per cent	3.5	119	5.5	55
Bond No. 1—3 per cent	3.5	119	2.7	33
Bond No. 1—5 per cent	3.6	105	6.6	65
Bond No. 3—3 per cent	3.6	115	3.9	43
Bond No. 3—5 per cent	3.5	105	7.3	90

Book Review

Micrometrics, by J. M. Dalla-Valle. Blue cloth bound, 428 pages, 100 figures, 82 tables. Published by Pitman Publishing Corp., 2 West 45th St., New York, N. Y. Price, $8.50.

This book deals with behavior

Officials of Lynchburg Foundry Co. receiving the Maritime "M" flag awarded the Lynchburg and Radford, Va., plants for outstanding production achievement in the emergency shipbuilding program, at ceremonies held at Radford, July 10. Left to right: Congressman C. A. Woodrum; Plant Manager R. S. Dower; Vice-President and General Manager of Lynchburg, Max Kuniansky, National Director of A.F.A.; Macon P. Miller, former Plant Manager; Chas. E. Walsh, Jr., Director of Procurement, U. S. Maritime Commission.

**Transactions, American Foundrymen's Association, vol. 32, part 2, p. 238 (1925).

of particles in the range of 10^{-1} to 10^{5} microns. This particle size range includes those in the submicroscopic, microscopic and relatively macroscopic sizes. The reviewer believes that this book would be of value to persons interested in the control of dusts and other fine particles in the foundry and to researchers in the field of sand control, both those in foundries and those who are producers. It should also be of value to refractory and crucible manufacturers and to those who make special facing materials.

This text is intended as a guide to the general behavior and characteristics of small particles. The size range of particles covered is from the colloid to particles an inch in diameter.

The book is divided into 18 sections dealing with the dynamics of small particles, their size-distribution and shape, methods of measurement, theory of sieving and grading materials, characteristics of packings, electrical, optical and sonic properties, thermodynamics of small particles, their chemical properties, flow of liquids through packings, infiltration and particle moisture relationships, capillarity, particle surface determinations, muds and slurries, transport of particles, theory of fine grinding, collection and separation of particle matter from air and dust.

The final chapter of the book is an extended selected bibliography. An appendix covering constants, conversion factors, temperature conversion equations and electrical conversion units also is included.

Presenting: The 1943 Winners in National A.F.A. Apprentice Contests

THE young men shown here, apprentices in patternmaking and molding, were adjudged the winners in the 1943 National Apprentice Contests sponsored by the Apprentice Training Committee of A.F.A. Some of them have won prizes in more than one annual contest. All of them, for their desire to learn and to improve their workmanship, are a credit to the firms they represent. Their entries, selected as the best from among several hundred entries in chapter area and local plant contests, were displayed at the St. Louis Congress this year, where the final awards were made.

Gregory Reindl
3rd—Non-Ferrous Molding.
Wisconsin Aluminum Foundry Co., Milwaukee, Wis.

Edward H. Drebus
2nd—Non-Ferrous Molding.
Universal Foundry Co., Oshkosh, Wis.

Arthur Tazalla
3rd—Steel Molding.
Maynard Electric Steel Castings Co., Milwaukee, Wis.

Theodore H. Anderson
2nd—Gray Iron Molding.
Browne & Sharpe Mfg. Co., Providence, R. I.

Clarence Kasper
2nd—Steel Molding.
Continental Roll & Steel Foundry Co., E. Chicago, Ind.

George Metzler
1st—Steel Molding
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

Wm. Waddicor, Jr.
2nd—Patternmaking.
Brown & Sharpe Mfg. Co.
Providence, R. I.

L. R. Kinsinger
1st—Gray Iron Molding.
Caterpillar Tractor Co., Peoria, Ill.

Brandon Elias
3rd—Patternmaking.
International Harvester Co., Tractor Works, Chicago.

Ralph Peterson
1st—Patternmaking.
Central Pattern Co., St. Louis

Michael Slivka
3rd—Gray Iron Molding
Hill Acme Co., Cleveland

New Association Members

A total of 77 new members enrolled . . . 19 Chapters represented in the enrollment . . . and 36 Company Members converted into Sustaining memberships . . . that is the score for the month ending July 15, a fine showing by our progressive Chapters. Chicago Chapter alone contributed 17 new members. Especially gratifying is the large list of firms who chose to become Sustaining members at the beginning of the new fiscal year, thus contributing splendidly to Association activities.

(June 16 to July 15, 1943)

SUSTAINING

Dalmo Victor, Inc., San Francisco. (Tomlinson I. Moseley, President)

CONVERSIONS

Sustaining from Company

W. D. Allen Mfg. Co., Chicago. (H. E. Meng, V.P.)
American Chain & Cable Co., Inc., York, Pa. (H. S. Malsberger, Foundry Supt.)
American Manganese Bronze Co., Holmesburg, Philadelphia. (T. H. Addie, President)
Builders Iron Foundry, Providence, R. I. (H. S. Chafee, Secretary)
Burt Foundry Co., Toledo, Ohio. (James C. Burt, President)
City Pattern Works, Detroit. (Vaughan Reid, President-Gen. Mgr.)
Cochrane Brass Foundry, York, Pa. (John H. Cochrane)
Columbia Steel Casting Co., Portland, Ore. (Hobart M. Bird, President)
Crucible Steel Casting Co., Cleveland. (Bruce Aiken)
Dayton Steel Foundry Co., Dayton, Ohio
DeLaval Separator Co., Poughkeepsie, N. Y. (Theo. H. Miller, Works Mgr.)
Dodge Steel Co., Philadelphia. (Chester S. Roberts, Vice President)
The Duriron Co., Dayton, Ohio. (Robert C. Schenck, Secretary)
Elyria Foundry Co., Elyria, Ohio. (W. F. Gollmar, Manager)
Enterprise Engine & Foundry Co., San Francisco. (Chas. Hoehn, President)
Fahralloy Canada, Ltd., Orillia, Ont. (W. J. Hall, Works Mgr.)
Fort Pitt Steel Casting Co., McKeesport, Pa. (Ralph N. Schaper, Plant Mgr.)
Fremont Foundry Co., Fremont, Ohio. (C. J. Miller, President)
General Iron Works Co., Denver, Colo. (M. R. Nelson)
Hamilton Brass & Aluminum Castings Co., Hamilton, Ohio. (Chas. E. Koehler, Treas.)
Hills-McCanna Co., Chicago. (Dan W. Moll, Vice Pres.)
Locomotive Finished Material Co., Atchison, Kans. (H. E. Muchnic, President)
Michigan Steel Casting Co., Detroit. (E. D. Flintermann, President)
Minneapolis Electric Steel Castings Co., Minneapolis, Minn. (S. V. Wood, President)
National Malleable & Steel Castings Co., Cleveland. (Walton L. Wood, Vice Pres. of Operations)
Northern Malleable Iron Co., St. Paul, Minn. (A. M. Fulton, Supt.)
Oberhelman-Ritter Foundry Co., Cincinnati. (Harold Ritter, Co-Owner)
Ohio Injector Co., Wadsworth, Ohio. (E. F. Hess, Met. Engineer)
Olympic Steel Works, Seattle, Wash. (E. R. Hinton, Vice President)
Pacific Steel Casting Co., Berkeley, Calif. (I. L. Johnson)
A. P. Smith Mfg. Co., East Orange, N. J. (D. F. O'Brien, President)
Taylor-Wharton Iron & Steel Co., High Bridge, N. J. (Geo. R. Hanks, President)
Texas Electric Steel Casting Co., Houston, Texas.
Textile Machine Works, Reading, Pa. (H. P. Good)
Vulcan Iron Works, Ltd., Winnipeg, Man. (J. D. McDonald, President)
Wagner Malleable Iron Co., Decatur, Ill. (John A. Wagner, President)

Company from Personal

Banner Iron Works, St. Louis. (W. E. Illig, Vice Pres.)
Wisconsin Appleton Co., South Milwaukee, Wis. (E. B. Hansen, Secretary)

*Company Members.

Birmingham Chapter

*Keller Foundry Co., Knoxville, Tenn. (J. W. Keller, Manager)

Central Indiana Chapter

Stephen Dolzall, Supt., Federal Foundry Co., Indianapolis, Ind.
Daniel Templeton, Supt., Bedford Foundry, Delco Remy, Bedford, Ind.

Central New York Chapter

Edw. E. Hook, Service Engineer, Dayton Oil Co., Dayton, Ohio.
Wm. G. Lewis, Jr., W. G. Lewis Co., Watertown, N. Y.
Dr. G. E. R. Saleh, Salium Steel Company of America, New York, N. Y

Chesapeake Chapter

*Colonial Casting Co., New Oxford, Pa. (P. E. Desch, General Mgr.)

Chicago Chapter

A. J. Brown, Engineer, Whiting Corp., Harvey, Ill.
A. C. Erlandson, Foundry Foreman, Pettibone Mulliken Corp., Chicago, Ill.
James T. Haxton, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
Chester A. Henry, General Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago.
John R. Hoffman, General Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago.
Henry Hycner, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
William B. Kehoe, General Foreman, Coreroom, Dodge-Chicago Plant, Chrysler Corp., Chicago.
Melvin H. King, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
James J. Kuker, Chief Metallurgist, Pettibone Mulliken Corp., Chicago, Ill.
Joseph Lapacek, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
Walter E. Larsen, Foundry Foreman, Pettibone Mulliken Corp., Chicago, Ill.
Edwin I. Lynn, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
Herman Meyer, Foreman, Melting Dept., Pettibone Mulliken Corp., Chicago, Ill.
Richard M. Rath, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
Harry C. Sallac, Foreman, Dodge-Chicago Plant, Chrysler Corp., Chicago, Ill.
F. S. Sutherland, Continental Roll & Steel Foundry Co., East Chicago, Ind.
Clyde Wyman, Metallurgist, Burnside Steel Foundry Co., Chicago, Ill.

Cincinnati District Chapter

Wm. A. Ross, Ross Pattern & Foundry Engineering Co., Sidney, O.
E. Vargo, Charge of Quality Control, Wellman Bronze & Aluminum Co., Cleveland, O.

Detroit Chapter

John F. McConnell, Foreman Cleaning Room, Pontiac Motor Div., General Motors Corp., Pontiac, Mich.

Metropolitan Chapter

*Basic Magnesium Incorporated, New York. (H. Mills Garner, Chief Engineer, Fabrication Service)
Philip R. Marvin, Chief Met. Engineer, Bendix Aviation Corp., Brooklyn, N. Y.
*Singer Mfg. Co., Elizabeth, N. J. (P. F. Nydegger)

Michiana Chapter

James C. Maggart, Coreroom Foreman, Sibley Machine & Foundry Corp., South Bend, Ind.
Edward S. Wegenke, Labor Supt., Sibley Machine & Foundry Corp., South Bend, Ind.

Northeastern Ohio Chapter

John W. Clarke, Asst. Supt. of Fdries., General Electric Co., Erie, Pa.
*National Malleable & Steel Castings Co., Cleveland, (Charles H. McCrea, President)
Walter E. Sicha, Metallurgist, Aluminum Company of America, Cleveland.

Northern California Chapter

Daniel T. Bergman, Engineer-Mgr., San Francisco Brass Die-Casting Co., San Francisco.
Peter Caird, Manager, Service Pattern & Aluminum Foundry Co., Oakland, Calif.
Leslie M. Edwards, Asst. Supt., Dalmo Victor, Inc., San Francisco.
Gerard J. Frinchaboy, Molder Apprentice, Enterprise Engine & Foundry Co., So. San Francisco, Calif.
Harold L. Heakin, Sales Engineer, Pacific Foundry Co., San Francisco.
A. W. Knutson, Foundry Supt., Joshua Hendy Iron Works, Sunnyvale, Calif.
Pete Segura, (Melter) Cupola Foreman, Joshua Hendy Iron Works, Sunnyvale.
William F. U'Ren, Salesman, Columbia Steel Co., San Francisco
*Dalmo Victor, Inc., San Francisco. (Tomlinson I. Moseley, President)

Ontario Chapter

N. Auchinvole, Asst. Plant Supt., Dominion Wheel & Foundries, Toronto, Ont.
Wm. J. Brill, Foundry Foreman, Canadian General Electric Co., Davenport Works, Toronto
*Canada Electric Castings, Ltd., Orillia, Ont. (C. E. N. Norton, Foundry Engr.)
C. C. Cariss, Chief Engineer, Waterous Limited, Brantford, Ont.
*Chadwick-Carroll Brass & Fixtures, Ltd., Hamilton, Ont. (E. F. Birt, Supt.)
O. A. Davies, Foundry Foreman, Standard Sanitary & Dominion Radiator Ltd., Toronto.
M. N. Tallman, Asst. Supt., A. H. Tallman Bronze Co., Ltd., Hamilton

Philadelphia Chapter

*Lancaster Malleable Castings Co., Lancaster, Pa. (H. Lloyd Hess, President)
F. B. Zelley, Radiographer, Cramp Shipbuilding Co., Philadelphia

Quad-City Chapter

Chas. Brusso, Zimmerman Steel Casting Co., Bettendorf, Iowa

St. Louis District Chapter

G. Fred Driemeyer, General Steel Castings Corp., Granite City, Ill.
M. D. Welliever, Foreman, General Steel Castings Corp., Commonwealth Div., Granite City, Ill.

Southern California Chapter

Merle Luce Bartoo, X-ray Analyst, X-Ray Products Corp., Los Angeles
Stanley W. Brand, Sales & Service, Snyder Foundry Supply Co., Los Angeles
Charles D. Perriguey, Coreroom Foreman, So-Cal Foundry, Los Angeles
J. E. Randall, Dist. Manager, E. A. Wilcox Co., Los Angeles.
Henry A. Solow, Metallurgist & X-ray Analyst, X-Ray Products Corp., Los Angeles
*X-Ray Products Corp., Los Angeles. (Justin G. Schneeman, President)

Western Michigan Chapter

*C. W. C. Crankshaft Corp., Muskegon Heights, Mich. (E. C. Bumke)
*Campbell, Wyant & Cannon Foundry Co., National Motor Castings Div., South Haven, Mich. (C. L. Beatty)
*Campbell, Wyant & Cannon Foundry Co., Plant No. 3, Muskegon Heights, Mich. (W. E. George, Asst. to Management)

Western New York Chapter

*Bison Castings, Inc., Buffalo, N. Y. (A. W. Murray, General Manager)
Myron L. Doelman, National Engineering Co., Chicago
David Levinson, Asst. Metallurgist, Acme Steel & Malleable Iron Works, Buffalo
Leo J. Moriarity, Foundry Supt., Dunkirk Foundries, Dunkirk, N. Y.

Wisconsin Chapter

Walter W. Eichenberger, Asst. Open-Hearth Supt., Falk Corp., Milwaukee
Frank Mason, Foundry Supt., Aelco Brass Foundry, Inc., Milwaukee

Outside of Chapter

Wm. H. Albohn, Foundry Service, Miller & Zehrung Chemical Co., Portland, Ore.
Thornton C. Bunch, Master Molder, Pearl Harbor Navy Yard, Honolulu, T. H.
Alex Crawford, Director, Jaques Bros. Pty. Ltd., Richmond, Victoria, Australia
Lester R. Lenhart, Paxton-Mitchell Co., Omaha, Neb.
*Salmon Bay Foundry Co., Inc., Seattle, Wash. (John Tracy, President)
Frank White, Paxton-Mitchell Co., Omaha, Neb.

Book Review

Time Study for Cost Control, by Phil Carroll, Jr., Blue cloth bound, 301 pages, 60 illustrations and tables. Published by McGraw-Hill Book Co., New York. Price, $3.00.

This is the second edition of this interesting and worthwhile book which can be used directly in the shop. In the foreword, written by C. D. Dyer, Jr., president, Dryer Engineers, Inc., Cleveland, and himself a leading advocate of time study, it is stated of the author:

"The author, with an extensive background of practical and, more to the point, successful experience, approaches his subject from a constructive base. He departs from the all too common practice of dealing with his subject as a theoretical concept and confines himself to discussion of principles proved through tested practice. . . . It is a pleasure to endorse this book in the sincere belief that it constitutes a real contribution to our store of technical knowledge."

The book is a complete manual for industrial engineers and shop executives who wish to fully understand time-study methods in order to plan and supervise the installation or improvement of a time-study system. It explains the application and advantages of time-study based on predetermined standards, describes personnel and equipment of a standards department, and outlines, step by step, a practical method of completing the time-study measurement and control of cost without rearranging the shop.

Government Orders of the Day for Industry

More detailed information on any of the following news briefs may be obtained by writing direct to the U. S. Information Center, 1400 Pennsylvania Ave., N.W., Washington, D. C. For prompt reply, it is suggested that requests be made by Release numbers shown.

Materials

Ferrochromium Priced (OPA)—Specific dollars-cents maximum prices for ferrochromium and chromium metal announced in MPR-407, eff. July 1. *(Release No. OPA-2688)*

Ferrochromium Schedule (OPA)—Schedule of differential premiums independent warehousemen may charge in sales of ferrochromium and chromium metal announced June 29, provided in Amend. 1 to MPR-407, eff. July 1. *Release No. TCS-197)*

Chrome Ore Differentials. (OPA)—Buyers of chrome ores may be charged transportation from unloading docks to users' plants in basing point cities, under Amend. 3 to MPR No. 258 (Chrome Ores), eff. July 20. *(Release No. TCS-439)*

Ferromanganese Priced (OPA)—Specific dollars-cents maximum prices for ferromanganese and manganese alloys and metals announced June 28, after consultation with producing industry and representative consumers, under Rev. MPR No. 138, eff. July 1. *(Release No. TCS-172)*

Zinc Shortage Serious (WPB)—Zinc rated as among materials whose supply is critically inadequate to meet wartime needs. *(Release No. TCS-11)*

Linseed Oil Reserve (Dept. Agr.)—Crushers directed by WFA, June 23, to reserve 45% of future raw oil production; holders of 240,000 lbs. or more of all linseed oils directed to reserve 25% of present inventories. *(Release No. AG-554)*

Core Binder Price (OPA)—Core binder exempted from price control July 3, by Amend. 18 to Suppl. Reg. No. 1 to Max. Price Reg. *(Release No. TCS-282)*

Secondary Aluminum Price (OPA)—Maximum base price of secondary aluminum ingot reduced by 1c per lb. to 14c level of primary aluminum pig. *(Release No. OPA-T-1048)*

Price Aluminum Ingot (OPA)—Maximum prices provided July 7 for primary grade aluminum ingot, a new grade made by blending 50-70% scrap with primary metal, under Amend. 1 to MPR-2, eff. July 12. *(Release No. TCS-337)*

Idle Copper Recovery (WPB)—To increase supply of copper and copper-base alloy materials, program announced June 26 for recovery of idle and excess inventories in hands of plumbers, building contractors and their suppliers. *(Release No. TCS-146)*

Extend Copper Restrictions(WPB)—List of copper and copper-base alloy building materials not permitted for civilian use expanded June 24 by Conservation Order M-9-c-4 as amended. *(Release No. TCS-106)*

B.F. Coke Report (Dept. Int.)—Report outlining possible methods for improving quality and uniformity of blast furnace coke published by Bur. of Mines. *(Release No. TCS-248)*

Regulate Refractories (OPA)—Basic refractory brick, dead-burned dolomite, dead-burned grain magnesite and kindred basic refractory products placed under separate price regulation, MPR-416, eff. July 3. *(Release No. TCS-170)*

Seek Fluorspar Margin. (WPB)—Fluorspar stock not accumulating in sufficient quantity to insure a satisfactory margin, with every effort being made to accelerate production. *(Release No. TCS-299)*

Fluorspar Prices (OPA)—General increases of approx. $5 ton in maximum prices for all grades of fluorspar, announced July 1. *Releases Nos. OPA-2758, TCS-299)*

Product

Tractor Parts Control (WPB)—Control of distribution of repair parts for track-laying tractors simplified by Limitation Order L53-b, amended June 17. *(Release No. TCS-65)*

Order P-100 Revoked (WPB)—Preference Rating Order P-100 dealing with maintenance, repair and operating supplies, completely revoked. *(Release No. TCS-219)*

Revise Steel Differentials. (OPA)—Quantity differentials on maximum prices for steel castings revised July 14 under Amend. 7 to Rev. Price Schedule No. 41 (Steel Castings), eff. July 20, to meet changed conditions and deliveries. *(Release No. TCS-447)*

Steel Casting Reserve (WPB)—To provide supply of steel castings to meet emergency maintenance, repair, operating demands, MRO Emergency Load Directives issued to castings producers by Steel Div., reserving percentage of expected monthly production. *(Release No. TCS-214)*

Cast Steel Machining Base (OPA)—Maximum charges producers may make for machining steel castings for sale established June 22 on the March 31 base, through Amend. 6 to Rev. MPS 41, eff. June 28. *(Release No. TCS-79)*

Estimate Cast Iron Needs (WPB)—Total industrial requirement of cast iron for construction and machinery and equipment in 1943 estimated July 7 at 904,800 short tons. *(Release No. TCS-346)*

Valve Shortage (WPB)—To relieve critical shortage of new steel valves, all users of new high-pressure steel valves called upon July 9 to list surplus items in sizes of ¼ in. and upward. *(Release No. TCS-376)*

Locomotive Parts (WPB)—Eff. July 1, delivery of 54 critical locomotive equipment parts can be made only in accordance with schedules approved by WPB, under Limitation Order L-97-d. *(Release No. TCS-152)*

New Farm Machinery Order (WPB)—Approval of new farm machinery order L-257, eff. July 1, expressed by Farm Machinery and Equipment Industry Advisory Committee at recent Washington meeting. *(Release No. TCS-140)*

Scrap

Assure Steel Scrap Market (WPB)—Ready market for collections of iron and steel scrap declared assured by plan recently released by Committee on Scrap of American Iron and Steel Institute, announced June 30. *(Release No. TCS-215)*

Steel Scrap Segregation (WPB)—Order M-24-c, issued last year and requiring segregation of alloy steel scrap, reissued July 6 to cover recently developed alloy steels and irons, with announcement that all WPB orders will be used to enforce compliance. *(Release No. TCS-320)*

Aluminum Scrap Rule (WPB)—More precise rules for distribution of aluminum scrap derived from aircraft wreckage and ship repairs laid down June 26. *(Release No. TCS-150)*

Magnesium Scrap Fees (OPA)—Buyers of magnesium scrap may pay dealers service charge for picking up scrap and loading into rail cars, under Amend. 1 to MPR-302, eff. July 1. *(Release No. TCS-118)*

Copper Conversion Fees (OPA)—New ceiling put on fees and charges for conversion of copper and copper alloy scrap in toll transactions, under Amend. 2 to MPR-20, eff. July 14. *(Release No. TCS-355)*

Equipment

Machinery Pricing (OPA)—New methods for obtaining adjustments of maximum prices provided wholesalers of machinery essential to war program, under Amend. 92 to Reg. 136, eff. June 25. *(Release No. OPA-2692)*

Simplify Tool Allocations (WPB)—Simpler and more effective method of allocating machine tools to purchasers other than those obtaining tools through Armed Services, established under Gen. Pref. Order E-1-b as amended, issued July 5. *(Release No. TCS-342)*

Laboratory

Aid for Laboratories (WPB)—Priority assistance for materials required by scientific and technological laboratories affected by two amended orders—P-43 and L-144—issued June 28. *(Release No. TCS-174)*

CHAPTER ACTIVITIES News

See page 29 for list of Chapter representatives whose reports of local activities appear in this issue.

Western New York Holds Its Annual Election of Officers

By J. Ralph Turner

OVER 200 members and guests attended the annual meeting of the Western New York Chapter of A.F.A., held June 25 at the Hotel Buffalo, Buffalo, for election of officers and directors. Chapter Chairman Ralph T. Rycroft, Jewell Alloy & Malleable Co., Inc., presided and opened the meeting and first heard the reports of committee chairmen.

Martin W. Pohlman, Pohlman Foundry Co. Inc., presented the Treasurer's report; Harold J. Struebing, Electro Refractories & Alloys Corp., as Chairman of the Membership Committee; William S. Miller, C. C. Kawin Co., for the War Problems Committee; Reinhold D. Loesch, Lake Erie Foundry Co., the Cupola Research Committee, and Frank E. Bates, Worthington Pump & Machinery Corp., Chairman of the Program Committee. Chairman Rycroft thanked each one for his work during the past year.

Election of Officers

The names of candidates for officers and directors then were placed before the meeting in nomination, and there being no further nominations, Secretary John R. Wark, Queen City Sand & Supply Co., was directed to cast a unanimous ballot for the following members:

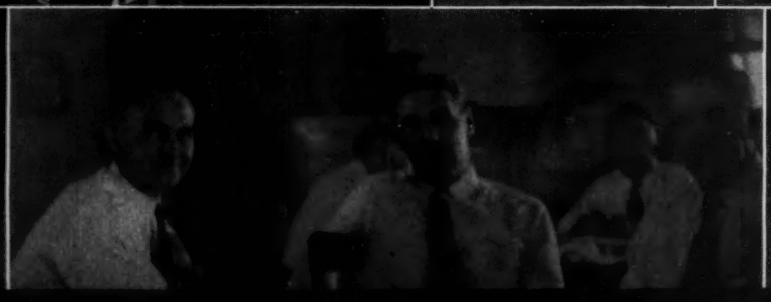
Chairman, Frank E. Bates; *Vice-Chairman,* Reinhold D. Loesch; *Secretary,* J. Ralph Turner; *Treasurer,* Martin W. Pohlman (re-elected); *Directors* (terms to expire in 1946): Charles O. Burgess, Union Carbide & Carbon Research Laboratories, Niagara Falls; Martin J. O'Brein; Symington-Gould Corp., Depew; James L. Yates, Worthington Pump & Machinery Corp., Buffalo.

In addition, Retiring Chairman R. T. Rycroft was elected a *Director* for a 1-year term, and Henry F. Sproull, A. P. Green Fire Brick Co., Buffalo, was elected *Director* to fill the unexpired term of the newly elected Secretary, J. Ralph Turner.

The new Chapter Chairman, Frank E. Bates, was presented with a gavel by Director James E. Yates, Worthington Pump & Machinery Corp., as a gift from his fellow A.F.A. members at the Worthington company. Mr. Bates then took over and announced that the Chapter had sent an invitation to A.F.A. headquarters in Chicago, asking that the Association hold its 1944 Congress in Buffalo.

Members of the Cincinnati District Chapter of A.F.A. and their friends enjoying the day's activities at the Chapter's annual picnic and outing, at Hyde Park Golf and Country Club, near Cincinnati, on June 16.

(Photos courtesy Ed King, Hill & Griffith Co.)



Reporters on Chapter Activities

Officers and representatives of A.F.A. chapters and other foundry groups who sent in the reports of recent local activities shown on the preceding pages of this issue are identified below:

Western New York—J. Ralph Turner, Queen City Sand & Supply Co., Buffalo, N. Y.; Chapter Secretary.

Cincinnati—Henry M. Wood, W. W. Sly Mfg. Co., Cincinnati; Chapter Secretary.

Quad City—H. L. Creps, Frank Foundries Corp., Moline, Ill.; Chapter Secretary-Treasurer.

New England Foundrymen's Association—Reported by Merton A. Hosmer, Hunt-Spiller Mfg. Corp., Boston.

Student Chapter Is Active During Summer

ACCORDING to H. F. Scobie, Instructor, Foundry Department, University of Minnesota, who also acts as faculty advisor for the A.F.A. Student Chapter in the institution, the Student Chapter at Minnesota is continuing its activities throughout the summer months.

It has inaugurated a series of meetings designed to stimulate friendship and understanding between the Student Chapter and the members of the Twin City Chapter. At each meeting, several local foundrymen will be invited as guests of the Student Chapter.

The first meeting was held July 9, and was pronounced a great success.

Refractories Topic of New Englanders

By Merton A. Hosmer

CHAPTER President A. W. Calder, New England Butt Co., Providence R. I., presided at the June 9 meeting of the New England Foundrymen's Association, held at the Engineers Club, Boston, with 85 members and guests present. Guest speaker was C. E. Bales, Ironton Fire Brick Co., Ironton, Ohio, on the important subject of "Conservation of Foundry Refractories."

Mr. Bales traced improvements in the manufacture of modern refractories, and stressed several points important to prolonging the life of refractories. Proper patching, he said, with the right materials, is essential to economical cupola operation, and scoring in the melting zone should be even and clearly defined. The correct air pressure is essential, and careful charging will greatly conserve refractories.

The speaker stated that more brick is consumed from poor slagging than from almost any other cause, pointing out that slag should be fluid at all times and removed promptly, and slag holes not allowed to become too large. Numerous questions from the floor evidenced the members' interest in the speaker's subject.

It was voted during the meeting that, in view of transportation difficulties in the East, the question of a summer outing should be tabled for the present.

Cincinnati Elects New Directors for Year

By Henry M. Wood

FOUR new Directors to serve during the next three years were elected at the June 16 meeting of the Cincinnati District Chapter of the Association, on the occasion of the annual stag outing at the Hyde Park Golf & Country Club, near Cincinnati. Over 235 members and guests turned out for the day of golf, baseball and outdoor activities, and the dinner and meeting in the evening.

As usual, Billy Gilbert, Buckeye Foundry Co., was responsible for the excellent golf arrangements, and prizes were awarded the winning golfers before the meeting was over. The afternoon baseball contest resulted in another victory for the Foundrymen over the Vendors, 8 to 5.

Chapter Chairman Frank E. Hutchinson, Reliance Foundry Co., presided during the evening, at which time the following were elected as new *Directors* of the Chapter:

W. J. Buvinger, Buckeye Foundry Co.; W. J. Love, Jr., The Lunkenheimer Co.; Jos. S. Schumacher, Cincinnati Milling Machine Co., and George S. Twachtman, Chris Erhart Foundry & Machine Co.

Quad City Ends Its Season With Picnic

By H. L. Creps

APPROXIMATELY 422 members and guests made a huge success of the Quad City Chapter's final event of the 1942-43 season, the annual picnic and outing held June 19 at Farmall Club, near Rock River, Moline, Ill. Golf at the Short Hills Country Club occupied the morning hours with a sports

Baseball, golf and conversation under a perfect summer's sun made the annual outing of the Cincinnati District Chapter, June 16, one to be long remembered.
(Photos by Ed King, Hill & Griffith Co.)

program and social sessions during the afternoon. To top off the day, a fish and chicken dinner was served, followed by an evening floor show.

It was announced at the time that the next meeting of the Chapter will be held September 20, when the newly elected officers and directors will embark upon another successful Chapter year.

Organizing New A.F.A. Chapter Deep in the Heart of Texas

AS THE result of an informal meeting held during the recent St. Louis Foundry Congress, foundrymen in Texas now are actively engaged in organizing a local Texas foundry group that may possibly lead to formation of a new A.F.A. chapter. Some 20 foundrymen of the Lone Star state attended the St. Louis meeting, and since then a local committee has been set up to develop meetings and arrange programs.

F. M. Wittlinger, Texas Electric Steel Casting Co., Houston, has accepted chairmanship of this local committee. Vice-Chairman is J. O. Klein, Texas Foundries Inc., Lufkin, Texas, who at one time was Chairman of the St. Louis District Chapter when he resided in that city.

Plan October Meetings

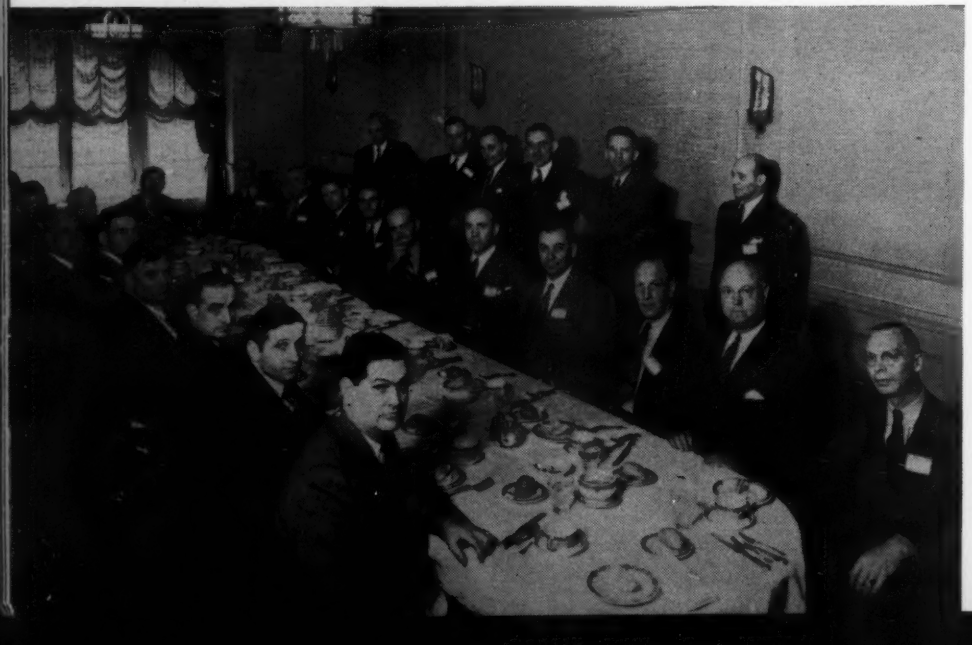
One of the first endeavors of the local committee is the sponsoring of a foundrymen's meeting to be held in Houston the latter part of October, followed by another meeting to be held at Dallas a few days later. It is announced that the guest speaker at these meetings will be R. G. McElwee, Vanadium Corp. of America, Detroit, Vice-Chairman of the Detroit Chapter, Chairman of the A.F.A. Cupola Research Project, and member of several other active A.F.A. Committees.

Plans also are going forward for another meeting later in the year. Foundrymen from all over Texas will be notified of these meetings, and because of the increasing importance of foundry work in the state during the past several years, a good turnout is expected.

Following are those who attended the St. Louis meeting in initiating the plans now well under way:

S. B. Armstrong, Hughes Tool Co., Houston.
L. H. August, Hughes Tool Co., Houston.
L. S. Bradshaw Jr., Texas Foundries, Inc., Lufkin.
Col. C. Chambers, Texas Foundries, Inc., Lufkin.
P. B. Croom, Cameron Iron Works, Inc., Houston.
A. C. Esdaly, Marshall Car Wheel & Foundry Co., Marshall.
W. C. Fleming, Hughes Tool Co., Houston.
Jas. H. Hopkins, Hopkins & Kendall, Houston.
S. W. House, Texas Steel Co., Fort Worth.
J. Kartye, Texas Foundries, Inc., Lufkin.
Robert Lang, Lufkin Foundry & Machine Co., Lufkin.
J. N. Laughlin, Madaras Steel Corp., Longview.
John Lloyd, Lloyd Metal Foundry, Houston.
Julius Madaras, Madaras Steel Corp., Longview.
J. A. Reeves, Hill & Griffith Co., Houston.
Gerald Smith, Texas Steel Co., Ft. Worth.
E. R. Starkweather, Lufkin Foundry & Machine Co., Lufkin.
Frederic J. Still, Madaras Steel Corp., Longview.
E. P. Trout, Lufkin Foundry & Machine Co., Lufkin.
F. M. Wittlinger, Texas Electric Steel Casting Co., Houston.
A. J. Edgar, Gray Iron Founders' Society, Washington, D. C.
John McBroom, Hydro-Arc Furnace Corp., La Grange, Ill.
S. E. McGinty, Firegan Sales Co., Chicago.
Howard A. Nelson, Hill & Griffith Co., Birmingham, Ala.
H. J. Pfeifer, Electro Metallurgical Sales Corp., Chicago.
H. H. Reich, Tabor Mfg. Co., Trussville, Ala.
C. B. Shanley, Semi-Steel Casting Co., St. Louis.
Thomas D. West, Deere & Co., Moline, Ill.

Since this informal meeting of Texas foundrymen, held April 29, during the St. Louis War Production Foundry Congress, a local committee has been organized to formulate plans for October foundry group meetings in Houston and Dallas, with the thought of eventually forming a Lone Star Chapter of A.F.A.



Mackinac Race Again Won by Foundryman

ONE peaceful pre-war July day in 1939, Anthony Herrman of Belle City Malleable Iron Co., sailed his 50-foot Q Class sloop "Gloriant" into Mackinac Island harbor on Lake Michigan to win the historic 331-mile yacht race from Chicago to Mackinac. On July 19, 1943, the "Gloriant" again won the Mackinac Cup, once again skippered by Tony Herrman, although he had sold the vessel some time ago.

The winning corrected time of the winner in the universal division was 51 hours 55 minutes 25 seconds, far better than the 1939 winning time of over 75 hours, and the "Gloriant" crossed the finish time only 37 seconds ahead of the runner-up. Approaching the finish, Skipper Herrmann was running slightly behind the leader but edged his sloop to windward of the other yacht to win the cup.

Abstracts

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Aluminum Alloys

GAS REMOVAL. *"Removing Gases and Inclusions in Aluminum Casting Alloys,"* Edwin Bremer, *The Foundry,* vol. 71, No. 6, June, 1943, pp. 126-128, 215-216. The use of finely divided scrap and scrap contaminated by oil, corrosion products, moisture, etc., results in excessive dross formation and gas in the form of pinhole porosity in the metal. The gaseous condition can be counteracted by the use of gas-fluxing with chlorine or nitrogen, melting and remelting, or salt fluxes. Gas-fluxes are introduced into the metal preferably through a carbon tube reaching within two inches from the crucible bottom. Gassing should be continued from 5 to 10 minutes per 100 pounds of metal at a temperature between 1250 and 1350°F. Melting the metal, allowing it to freeze in the pot, and then remelting it effects great improvement in the soundness of metal cast. Salt fluxes should be introduced near the bottom of the crucible. No matter what form of degasifier is used, care should be taken to see that additional gas and moisture are not introduced by the fluxing procedure. To prevent pick-up of moisture and gas from sand, the sand should have a minimum permeability of 25. Gating systems should allow the metal to flow smoothly into the mold and should provide means for preventing dross from entering the casting cavity.

Cast Iron

NICKEL ALLOY CAST IRONS. *"Notes on Foundry Practice for Low Nickel Alloy Irons (Up to 2% Nickel),"* *Canada's Foundry Journal,* vol. 16, No. 6, June, 1943, p. 16. Shrinkage allowance for patterns for low alloy pearlitic castings is about the same as for gray cast iron, 1/10 in. per ft. However, for low silicon nickel-chromium cast iron having a mottled structure, a slightly greater shrinkage allowance should be made. Low nickel alloys are suitable for pouring thin sections, for nickel tends to make the metal more fluid and thus compensates for a low phosphorus content. Pouring temperature should be determined with due consideration for the size of sections. In general, thin sections will require a higher pouring temperature than thick sections. Care should be taken not to select too low a pouring temperature in an attempt to obtain better surface finish on the casting. Nickel additions produce a tough, uniform matrix which tends to resist cracking and warping resulting from internal stresses.

PISTON RINGS. *"Piston Rings of Gray Iron,"* Tracy C. Jarrett, *Metals and Alloys,* vol. 17, No. 6, June, 1943, pp. 1188-1195. Piston rings, which are produced in widely varying sizes, all serve as seals. Gray cast iron is the most widely used material for piston rings because it retains its physical properties under varying conditions of temperature, pressure, lubrication. The distribution of soft graphite and steadite in a tough pearlitic matrix enables the gray iron to withstand wear well. Small piston rings require a fine grained structure, whereas large piston rings require a coarser structure. Piston rings should be of uniform structure, containing no porosity, free ferrite, or hard spots of cementite. In this country piston rings are generally made from individual castings which may be cast in large groups around a central sprue. After sand blasting and snagging, the faces are ground flat and parallel and hydrolapped to the correct thickness. They are turned to the proper ring diameter and bored to the correct wall thickness. Ring joints maintain ring tension and provide for thermal expansion. Accompanying this article are many illustrations of piston rings, microstructures, molds, and machining operations.

Centrifugal Casting

(See Steel.)

Chain

(See Steel.)

Cores

CORE BLOWING. *"Core Blowing in a Semi-Production Foundry,"* Z. J. Madacey, *The Foundry,* vol. 71, No. 6, June 1943, pp. 136-138, 230-233. Core blowers may be used successfully in semi-production shops provided their operation and applications are well understood. Sand condition is most important in core blowing. Dry sand will produce cores which will not hold their shape and size. The dry sand mix has a cutting action when it is blown in the core box. Oils in a dry sand oxidize very quickly. Then the oxidized sand wedges in vents and between loose pieces, causing many other difficulties. Cores made of sand which is too wet, sag and lose their shape. Excess water is blown off the individual sand grains and collects in pools, causing sand to stick to the core boxes. Operators of core blowers should be skilled. Supervisors should see that understudies are trained to take over the core blowing jobs at such times when the regular operators are absent. All departments in the foundry, and particularly the pattern shop, should cooperate fully to permit core production by blowing.

MOLDING MATERIALS. *"Molding Sands and Materials,"* 2d Report of the Molding Materials Sub-Committee of the Steel Castings Research Committee, *Foundry Trade Journal,* vol. 69, No. 1393, April 29, 1943, pp. 349-351, 357. The author describes how economies in the use of core materials may be effected by using binders only when absolutely necessary, using smaller amounts of binders, carefully measuring all materials included in core mixes, careful and thorough mixing, and utilization of waste products wherever possible.

CYLINDER HEAD. *(See Molding.)*

Core Ovens

STOKERS. *"Coal Stokers for Core Ovens,"* Arthur Roberts, Jr., *The Foundry,* vol. 70, No. 12, December, 1942, pp. 75, 160. The author describes the installation of stokers and temperature controls in hand-fired coke-burning core ovens in a foundry where neither gas nor oil were available.

Core Practice

COSTS. *(See Cost Accounting.)*

Cost Accounting

CORE COSTS. *"Allocate Core Costs to Individual Castings,"* Albert E. Grover, *The Foundry,* vol. 71, No. 6, June, 1943, pp. 130-132, 223-225. The author gives a detailed description of a system for accounting for the monthly core costs for patterns molded.

Cupola

REFRACTORIES. *(See Refractories.)*

Design of Castings

FLUID PRESSURE. *"Fluid Pressure in Foundry Practice,"* E. Longden, *Foundry Trade Journal,* vol. 70, No. 1396, May 20, 1943, pp. 45-50, 52. The author cites some of the laws and theories of fluid mechanics, and explains their effects on molds and castings.

MAGNESIUM ALLOY CASTINGS. *(See Magnesium.)*

PRINCIPLES OF CASTING DESIGN. *"Design of Sand Castings for Quantity Production,"* N. F. Hindle, *Metals and Alloys,* vol. 17, No. 4, April, 1943, pp. 770-775; vol. 17, No. 5, May, 1943, pp. 970-977; vol. 17, No. 6, June, 1943, pp. 1196-1202. The design of every casting poses different problems. However, experience and study have shown that certain practices give better results than others, and that adopting these practices will produce large quantities of better castings at a minimum cost. In order to properly design castings, the designer should have a comprehensive knowledge of the processes whereby castings are produced. He should be familiar with the various casting methods, the advantages and disadvantages of the various methods, pattern making, molding, core making, melting, pouring, and finishing of castings. He should be familiar with the properties of different alloys so that he may select the one which best satisfies the demands to be made on the finished

part. The designer and foundryman together should consider shrinkage allowances, risers, gating, parting, distortion allowances, machine finish allowances, draft, core prints, core boxes and driers, and locating points before the pattern is made. The designer should be familiar with the metallurgical characteristics of the metal chosen, so that his design will take into account those characteristics. The author explains how the best design principles are incorporated in individual castings. He lists twenty-one rules to be followed in the preliminary layout of a cast part, and emphasizes that the two most important principles to be observed are uniformity of section thickness and gradual blending of sections if uniformity of thickness is impossible.

Duplexing

MALLEABLE IRON. *(See Malleable Iron.)*

Electronics

ELECTRON MICROSCOPE. *"Applications of the Electron Microscope in Metallurgy,"* V. K. Zworykin, A.I.M.E. Technical Publication No. 1594, *Metals Technology,* vol. 10, No. 4, June, 1943, 23 pages. Electron beams passing through magnetic and electric fields with axial symmetry are deflected and focused, just as light rays passing through a glass lens are diffracted and focused to form an image. Electronic engineers have utilized this property in developing the electron microscope. Light microscopes have long reached the ultimate in magnification and resolving power possible with the use of an imaging medium having the wave lengths of light. However, using electron beams which have a much shorter wave length, it is possible to resolve detail one hundred times as fine. The specimen observed by the electron microscope must be less than one micron in thickness if the electrons are not to be absorbed. The space through which the electrons pass must be evacuated to prevent collisions of the electrons with molecules of air. The electronic lenses are formed by axially symmetric magnetic or electric fields, and not by any material substance. Aside from this, the parts of the electron microscope compare closely with those of a light microscope. The electron microscope has found application in diffraction studies, bacteriology, medicine, chemistry, and metallurgy. Since metallographic specimens are always too thick to permit penetration of electrons, either positive or negative replicas of their surface must be made and these are then examined with the electron microscope. The author describes the various ways by which surface reproductions can be made, and presents many photographs showing metal surfaces as seen by the electron microscope at a magnification up to 60,000.

Inspection

RADIOGRAPHY. *"A Rapid Gamma-Ray Inspection Technique,"* Robert C. Woods, *Metals and Alloys,* vol. 17, No. 4, April, 1943, pp. 764-766. The greatest disadvantage of gamma-ray inspection of metal parts is the long exposure times necessary. The use of a calcium tungstate screen in conjunction with two lead foil screens will shorten the length of exposure as much as 200 times in some cases. One lead screen is placed next to the film on the radium side to eliminate scattered rays. The calcium tungstate film is placed next to the film on the opposite side. Behind this is placed the second lead screen which cuts down backscatter. The film used with this setup should be very sensitive to the fluorescence of the calcium tungstate screen.

Magnesite

REFRACTORIES. *(See Refractories.)*

Magnesium

MAGNESIUM MELTING. *(See Non-Ferrous.)*

FIRE HAZARDS. *(See Safety.)*

PROPERTIES OF MAGNESIUM ALLOYS. *"Magnesium Properties as They Affect Design," Product Engineering,* vol. 14, No. 6, June, 1943, pp. 359-365. This article describes properties of magnesium alloys which should be considered in designing parts for magnesium alloys, such as compressive properties, strength in bending, hardness, wear resistance, resilience, toughness, and resistance to fatigue.

Malleable Iron

DUPLEXING. *"Duplexing Malleable Iron,"* Reg. Williams, *Canadian Metals and Metallurgical Industries,* vol. 6, No. 6, June, 1943, pp. 34-36. Iron to be duplexed at the McKinnon Industries, Ltd., is melted in a cupola, transferred to the electric furnace, superheated, adjusted to the desired chemical analysis, transferred to pouring stations, and poured into molds. The author gives a detailed description of the raw materials used; construction and lining of the cupola, forehearth, ladles, and electric furnace; cupola and electric furnace operation; sampling and determination and adjustment of chemical analysis; pouring of molds, and annealing furnaces.

PEARLITIC MALLEABLE IRON. *"Pearlitic Malleable Cast Irons,"* A. E. Peace, *Foundry Trade Journal,* vol. 70, No. 1399, June 10, 1943, pp. 109-114. Blackheart malleable iron is made from white cast iron composed of cementite and pearlite and containing no graphite.

The graphitization which changes the structure to graphite nodules in a ferrite matrix occurs in two steps—primary and secondary graphitization. White cast iron is heated to and held at some temperature above the critical while the free cementite dissolves in the austenitic matrix. Simultaneously the austenitic matrix rejects carbon in the form of primary graphite. When all of the cementite is completely dissolved, the iron is either slowly cooled to below the critical temperature while the austenite rejects secondary graphite, or rapidly cooled to just below the critical temperature where pearlite forms, and then is held at that temperature while secondary graphite is formed from pearlite. If the cooling process is conducted so rapidly that secondary graphite does not have a chance to precipitate, the resultant structure consists of primary graphite nodules in a matrix of one of the breakdown-constituents of austenite. Iron with this structure is called pearlitic malleable iron. The structure of pearlitic malleable iron gives it greater strength and hardness, but lower ductility than blackheart malleable iron. Attempts have been made to apply "austempering" to malleable iron. Blackheart malleable iron has also been reheated to above the critical to allow some of the graphite to redissolve, and then cooled to give a matrix of ferrite and pearlite in which the pearlite is concentrated along the grain boundaries. Heat treating ovens have been made smaller in size to permit the more careful temperature control necessary in the production of pearlitic malleable iron. Dissolved gases escaping from the metal during heat treatment seem to stimulate graphite nuclei formation and thus speed up graphitization. The presence of various gases in the furnace atmospheres has the opposite effect, probably because they oppose the escape of dissolved gases from metal during heat treatment.

Materials Handling

SLINGS. *"Plant Methods for Effective Use of Slings,"* C. R. Hochmuth, *Supervision,* vol. 5, No. 5, May, 1943, pp. 19-20. The Kearney and Trecker Corp. handle their heavy loads with wire-rope slings, except where polished surfaces are in contact with the rope, in which case manila rope slings are used. Worn rope is never used. Spliced eyes or loops are preferred to clip fastenings. Pre-formed rope does not "barb" on wearing and is more easily handled in splicing. After splicing, exposed strands are covered first with soft annealed wire and then soldered, to prevent the wire from unwinding. Manila-rope slings are hung in a dry place when not in use. Both manila and wire-rope slings are frequently inspected for damage. A lug of hard solder is cast on the ends of wire ropes to eliminate exposed ends, to serve as a means for attaching hoist ropes to the drums of overhead cranes, and to prevent slippage when clips are used.

Molding

CYLINDER HEAD. *"Cylinder Head Core Made Without Wires,"* Pat Dwyer, *The Foundry,* vol. 71, No. 2, February, 1943, pp. 84-85, 150-151. A method of making molds for air-cooled aircraft aluminum cylinder heads without the use of reinforcing wires in the sand vanes has been developed and is now in use. Ordinarily the time-consuming practice of setting wires was used to prevent collapse of the sand vanes either in the green state or when molten metal entered the mold. The author gives the alloy most frequently used for cylinder heads and briefly describes how the pattern is made. The pattern is split longitudinally and mounted on plates. The half-pattern plate is placed on a molding machine and surrounded with a metal core box. Sand is shaken into the vanes from an electrically-vibrated riddle mounted over the mold. This sand is packed by means of gravity and a vibrator on the pattern plate. Only six wires are inserted in the vanes near the joint. The rest of the mold is filled with a sand slinger. After the pattern is removed, the vanes are sprayed with casein. The mold is then baked. After baking the mold face is sprayed with a proprietary compound and smoked with an acetylene torch. Cores are set while the mold is in a horizontal position. The cope is then placed on the drag and sealed with a paste. The mold block is then set on end and poured in a vertical position. Two other cores containing runners, risers, and a pouring basin are added to the assembly. Metal enters the mold at the bottom and near the center. The author has also described other experimental methods which were less successful.

FLASKS. *"Heavy Moulding Boxes,"* Jas. Timbrell, *Foundry Trade Journal,* vol. 70, No. 1394, May 6, 1943, pp. 11-12. The author describes flask equipment suitable for heavy molds.

Mold Materials

CORE MOLDING. *(See Cores.)*

Piston Rings

CAST IRON. *(See Cast Iron.)*

Plant Equipment

SLINGS. *(See Materials Handling.)*

Non-Ferrous

CASTING TECHNIQUES. *"Relative Characteristics of Non-Ferrous Casting Techniques," The Iron Age,* vol. 151, No. 6, February 11, 1943, pp. 70-72. This article briefly discusses the various methods by which non-ferrous metals may be cast, and the advantages and disadvantages of each method. It describes the differences between the gooseneck- and cold-chamber-type of die casting machines and their products. Characteristics and tolerances of castings made by the various methods are presented in tabular form.

MAGNESIUM CASTINGS. *"Producing Magnesium Castings,"* Edwin Bremer, *The Foundry,* vol. 71, No. 2, February, 1943, pp. 76-81, 138-140. Although magnesium was first produced commercially in 1857, it was not until the First World War that it was produced for any use other than wire or ribbon for photographic purposes. Today magnesium has become an important industrial metal. The two principal casting alloys contain 9 per cent aluminum, 2 per cent zinc, 0.2 per cent manganese, and the balance magnesium, and 6 per cent aluminum, 3 per cent zinc, 0.2 per cent manganese, and the balance magnesium. The first alloy is generally heat treated, while the second alloy is used in the as cast condition. Physical properties of the two alloys are given by the author. Three characteristics of magnesium which necessitate special care and precautions in its handling are its light weight, its tendency to reduce silica, and its tendency to oxidize and burn. Its light weight makes the separation of flux and metal difficult. This is overcome by careful and proper handling and fluxing. Since magnesium reduces silica, all scrap should be abrasive blasted before it is remelted, in order to keep silicon pick-up at a minimum. Fires are mostly likely to occur in the melting and cleaning departments. Good housekeeping is the best preventive of fires. Sawdust, chips, and dust should not be allowed to accumulate. Molten metal should be covered with flux at all times. Pots and crucibles should be carefully examined and never used if their condition is doubtful. The author describes the melting and pouring methods used by his company, in which every possible means of maintaining cleanliness and preventing oxidation is practiced.

Radiography

ARMY-NAVY SPECIFICATIONS. *"Army-Navy Aeronautical Specifications for Radiography AN-QQ-M-188," Industrial Radiography,* vol. 1, No. 3, January, 1943, pp. 36-38, 49. This article is a reprint of the above specification.

Radiography

INSPECTION. *(See Inspection.)*

Refractories

CUPOLA REFRACTORIES. *"Conserving Foundry Refractories,"* C. E. Bales and F. McCarthy, *The Foundry,* vol. 71, No. 5, May, 1943, pp. 95, 180-182. The harder, denser, and tougher blocks which result from modern machine methods of making refractory blocks should enable the furnace operator to obtain long life from his furnace linings. However, efficient furnace operation is also essential if lining life is to be prolonged. In case of cupolas, blocks should be of the stiff mud, machine-pressed type. A double lining of blocks up to the charging door allows a large factor of safety against burning through of the lining. Patching is easier done against a solid block lining. A clearance should be allowed between the lining and the cupola shell to take care of expansion. A high quality, refractory bonding mortar should be used for laying up, rather than fire clay, if joint corrosion is to be avoided. After a cupola is lined, it should be thoroughly dried before a heat is run in order to prevent spalling of the cupola blocks. Before patching the lining should be carefully cleaned of all slag. Patching applied over slag will fall off when the slag melts during the next heat. Daubing mixtures should be made with high melting point materials. River sand, molding sand, yellow loam, or blue shale daubing muds should not be used. The air blast should be carefully controlled during cupola operation. Excessive blast will oxidize the iron and cause severe cutting in the melting zone. Charges containing much steel scrap will be harder on linings than charges containing little steel scrap, for steel requries a higher temperature for melting. Ordinary cupola slag is not too corrosive unless it contains a high percentage of metallic oxides, but it should be removed promptly from the furnace. Most fluxing materials are hard on cupola linings, and they should be charged no closer than 6 in. to the lining. The author also describes how long life may be obtained from cupola spout and ladle linings.

MAGNESITE. *"Magnesite Refractories,"* J. H. Chesters, *The Iron Age,* vol. 151, No. 22, June 3, 1943, pp. 46-51. The author discusses the sources of magnesite, properties of magnesite and the effect of firing on these properties. He also discusses the composition and behavior of binary and ternary magnesia systems.

Safety

MAGNESIUM FIRES. *"Preventing and Extinguishing Magnesium Fires,"* Harold A. Knight, *Metals and Alloys,* vol. 17, No. 5, May, 1943, pp. 960-966. Industry in general is still confused about the correct way to extinguish magnesium fires. Even organizations whose duty it is to test extinguishers and to determine the best means to prevent or extinguish magnesium fires reach contradictory conclusions. If an ideal extinguisher for magnesium fires existed, it would be non-abrasive, non-corrosive, non-inflammable, non-toxic, suitable for use on all size fires, inert to burning magnesium at any temperatures, a good conductor of heat, easy to supply and store, non-conductive of electricity, and not moisture absorbent. The author presents the findings of a survey of groups whose business it is to develop, produce, test, advocate, or use magnesium fire fighting methods and extinguishers. Also included in the article, in box form, are lists of preventive measures for magnesium fires.

Safety and Hygiene

CUTTING WIRE ROPE. *"Play Safe When Cutting Wire Rope,"* F. L. Spangler, *Occupational Hazards,* May, 1943, pp. 18-19, 34. Wire ropes should never be cut without first applying a seizing to insure against unlaying of the rope. The author gives a step-by-step description of the proper method for applying a seizing. Each step is photographically illustrated. The author also gives a table indicating the correct size of seizing wire to use for each diameter of wire rope.

Steel

CAST CHAIN. *"Cast Steel Chain,"* Technical Staff, Sorrel Steel Foundries Limited, *Canadian Metals and Metallurgical Industries,* vol. 6, No. 4, April, 1943, pp. 18-19. The authors describe the making of the longest and biggest cast steel chain ever produced in Canada. The chain was 2¼ in. in diameter and 1¼ miles long, cast in 90 ft. lengths.

CENTRIFUGAL CASTINGS. *"Steel Sheaves Are Cast Centrifugally,"* Anton Johnson, *The Foundry,* vol. 71, No. 6, June, 1943, pp. 139-141, 234-235. The author describes how the Oklahoma Steel Casting Co. produces steel sheaves by the centrifugal casting method.

CENTRIFUGAL CASTING. *"Centrifuging After the Mold Is Filled with Steel,"* W. F. Wright and J. B. Caine, *The Foundry,* vol. 71, No. 5, May, 1943, pp. 90-93, 175-176. Centrifuging molds after they are poured controls shrinkage during solidification, increases yield, and decreases costs, provided the design and size of the casting are such that they may be adapted to the centrifugal process. No difference in density has been found between sound steel cast centrifugally and sound steel cast statically. The essential part of the equipment for this type of centrifuging is a simple rotating table on which flask equipment may be centered and mounted for spinning. Often flask equipment in use for static casting may also be used for centrifugal casting. Gear blanks and sprockets are commonly cast by this method.

Design of casting must be suitable if the advantages of centrifuging are to be realized. Risers on the rims of spoke type gears may be eliminated provided channel or spoke cross sections are large enough to feed the rim. A combined gate and riser is placed at the hub to feed the entire casting. The size of casting which may be made centrifugally is limited by the smallest casting which will not solidify before spinning is started, and the largest casting which can be handled by the centrifuging equipment.

MANGANESE STEEL. *"Track Shoe Production," Canadian Metals and Metallurgical Industries,* vol. 6, No. 5, May, 1943, pp. 16-17, 20. Tank track shoes must be made from tough, long-wearing steel if they are to withstand the severe service to which they are subjected. The Hull Steel Foundries, Ltd., which produced parts of 14 per cent manganese steel for heavy, hard-wearing uses during peace time, has been able to convert their foundries to the production of track shoes, using the same alloy. The author describes the molding, core making, melting, cleaning, heat treating, and finishing operations used in their production.

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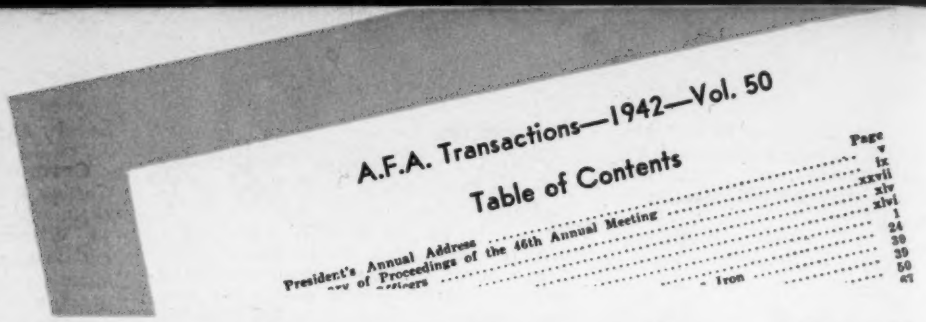
A.F.A. Transactions—1942—Vol. 50

Table of Contents

Page

President's Annual Address v
Proceedings of the 46th Annual Meeting ix
Iron xxvii
..... xlv
..... xlvi
..... 1
..... 24
..... 30
..... 39
..... 50
..... 67

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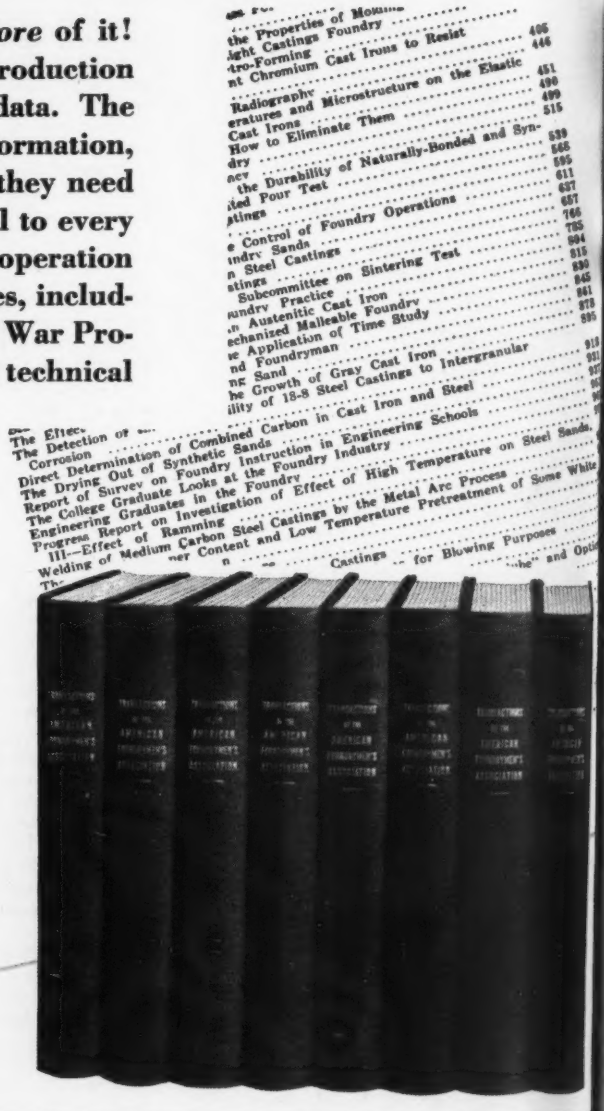
the Properties of Mo...
ight Castings Foundry 405
tro-Forming 446
nt Chromium Cast Irons to Resist
Radiography 451
eratures and Microstructure on the Elastic
Cast Irons 490
How to Eliminate Them 499
dry 515
ney
the Durability of Naturally-Bonded and Syn-
ited Pour Test 539
stings 568
e Control of Foundry Operations 595
indry Sands 611
n Steel Castings 637
stings 657
Subcommittee on Sintering Test 766
undry Practice 785
n Austenitic Cast Iron 804
echanized Malleable Foundry 815
e Application of Time Study 830
nd Foundryman 845
ng Sand 861
he Growth of Gray Cast Iron 878
ility of 18-8 Steel Castings to Intergranular
The Effect 895
The Detection of ...
Corrosion 913
Direct Determination of Combined Carbon in Cast Iron and Steel 921
The Drying Out of Synthetic Sands 937
Report of Survey on Foundry Instruction in Engineering Schools 947
The College Graduate Looks at the Foundry Industry 957
Engineering Graduates in the Foundry
Progress Report on Investigation of Effect of High Temperature on Steel Sands,
III—Effect of Ramming 967
Welding of Medium Carbon Steel Castings by the Metal Arc Process 981
...er Content and Low Temperature Pretreatment of Some White
Th... 995
n ... Castings ... for Blowing Purposes
...he" and Opti...

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